No. 697,740. Patented Apr. 15, 1902.

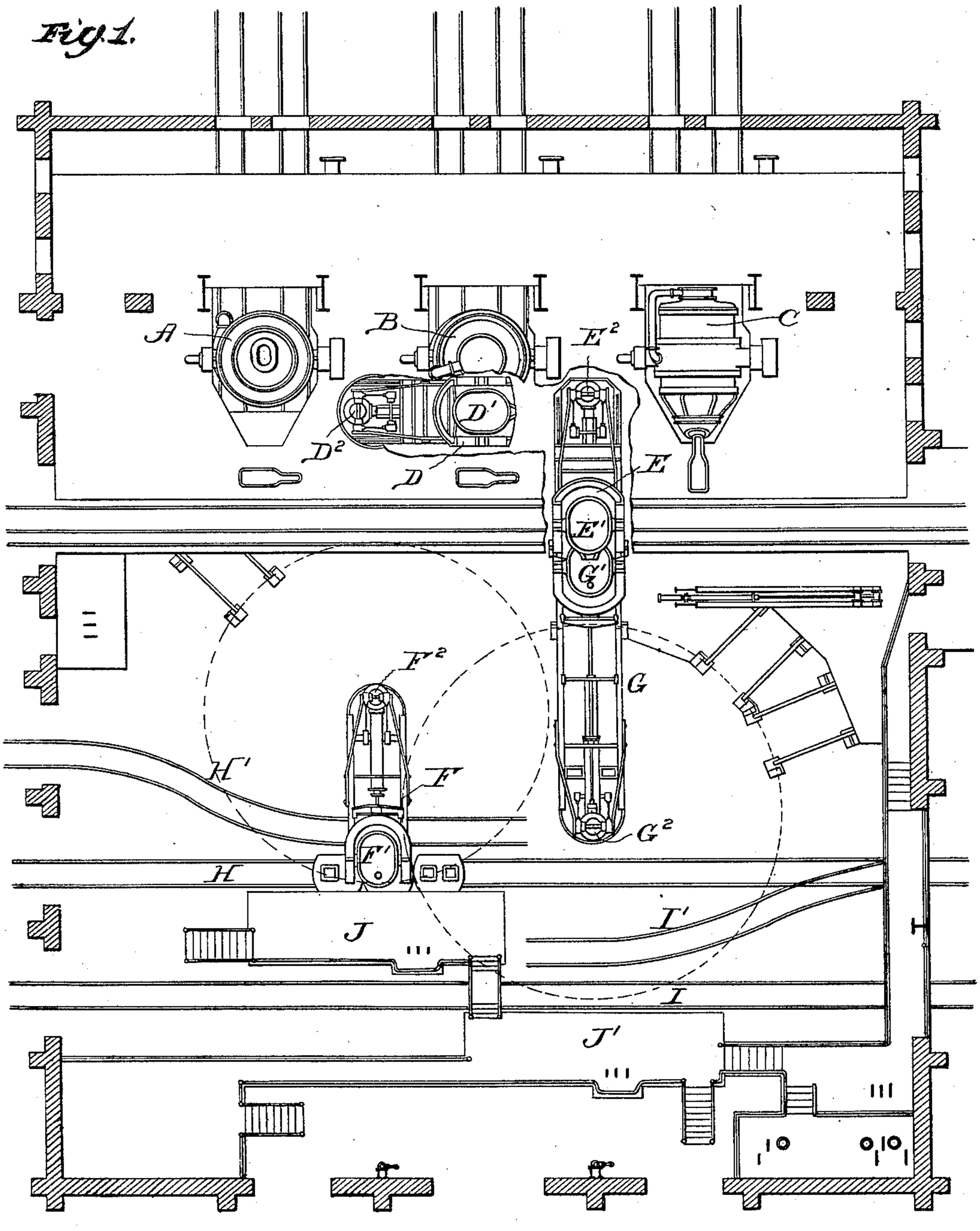
C. H. McCULLOUGH, Jr. & L. C. B. HOLMBOE.

BESSEMER STEEL PLANT.

(Application filed Jan. 7, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses:
Chas. E. Gaylord.
John Enders Jr.

Inventors:
{Charles H. McCullough Jr.,
Leonhard C. B. Holmboe.

By Bruning & Bruning
Attys.

No. 697,740. Patented Apr. 15, 1902.

C. H. McCULLOUGH, Jr. & L. C. B. HOLMBOE.

BESSEMER STEEL PLANT.

(Application filed Jan. 7, 1901.)

(No Model.) 4 Sheets—Sheet 2.

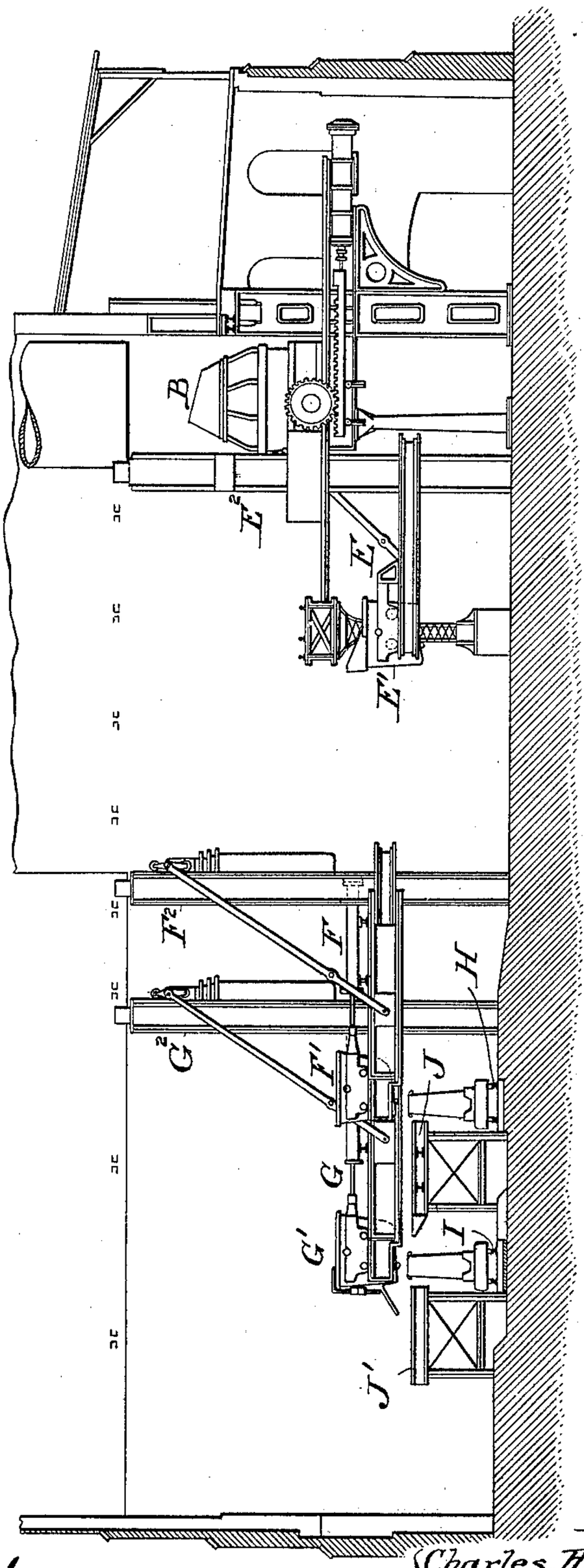


Fig. 2.

Witnesses:
Chas. E. Gaylord.
John Enders Jr.

Inventors:
{Charles H. McCullough Jr.,
{Leonard C. B. Holmboe,
By Fenning & Fenning
Attys.

No. 697,740. Patented Apr. 15, 1902.

C. H. McCULLOUGH, Jr. & L. C. B. HOLMBOE.

BESSEMER STEEL PLANT.

(Application filed Jan. 7, 1901.)

(No Model.) 4 Sheets—Sheet 3.

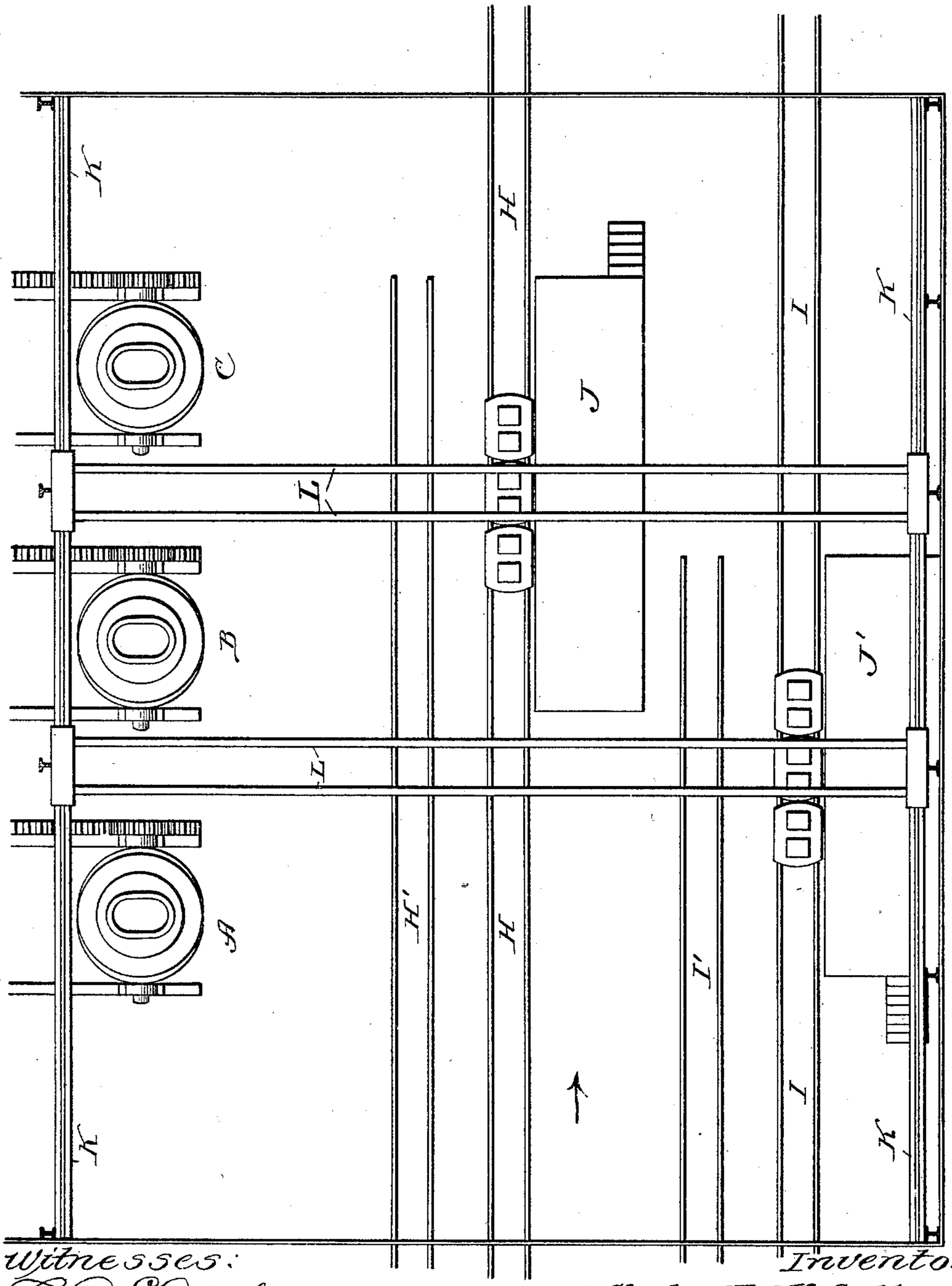


Fig. 3.

Witnesses:
Chas. E. Gaylord,
John Enders Jr.

Inventors:
{Charles H. McCullough Jr.,
{Leonhard C. B. Holmboe,
By Fanning & Fanning
Atty's.

No. 697,740. Patented Apr. 15, 1902.

C. H. McCULLOUGH, Jr. & L. C. B. HOLMBOE.

BESSEMER STEEL PLANT.

(Application filed Jan. 7, 1901.)

(No Model.) 4 Sheets—Sheet 4.

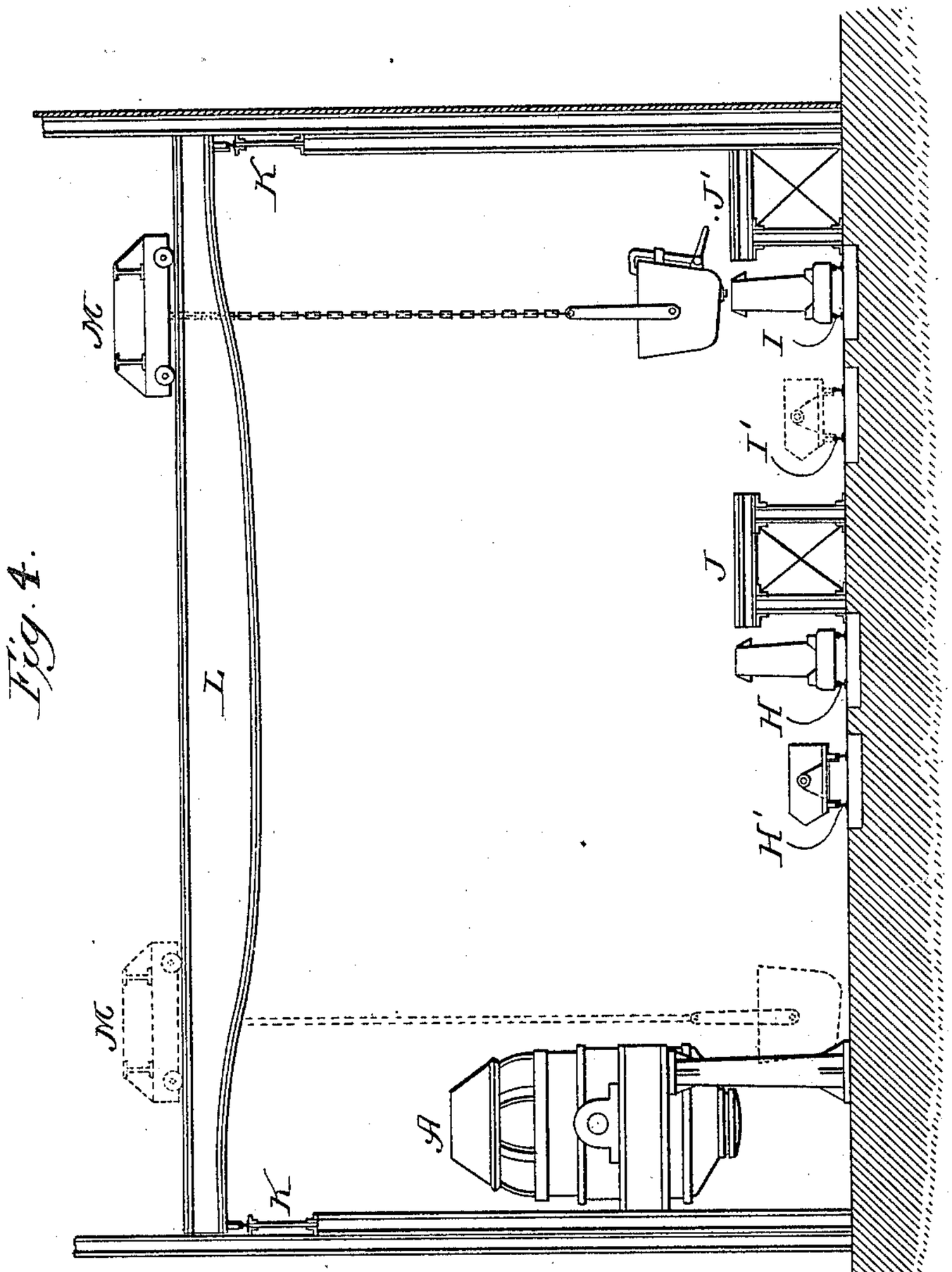


Fig. 4.

Witnesses:
Chas. E. Gaylord,
John Enders Jr.

Inventors:
{Charles H. McCullough Jr.,
Leonhard C. B. Holmboe,
By Fanning & Fanning,
Att'ys.

UNITED STATES PATENT OFFICE.

CHARLES H. McCULLOUGH, JR., AND LEONHARD C. B. HOLMBOE, OF CHICAGO, ILLINOIS.

BESSEMER-STEEL PLANT.

SPECIFICATION forming part of Letters Patent No. 697,740, dated April 15, 1902.

Application filed January 7, 1901. Serial No. 42,362. (No model.)

To all whom it may concern:

Be it known that we, CHARLES H. McCULLOUGH, Jr., and LEONHARD C. B. HOLMBOE, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, Ohio, have invented a certain new and useful Improvement in Bessemer-Steel Plants, of which the following is a specification.

It is desirable in the operation of plants for the production and manufacture of steel that the operation of such plants shall be conducted with precision and rapidity and with the greatest degree of continuous action possible. This is especially true of that division or section of steel plants where the converting is carried on for the purpose of facilitating the operation of the converters and the production of the steel ingots, and one form of arrangement to save time and increase the working capacity of the converters and the receiving and casting cranes for the ladles is to have three converters served by two cranes. This construction and arrangement of converters and cranes while possessing the advantages of saving time and labor and increasing the output of steel plants leaves such plants with some objectionable features, one of which is that both cranes deliver to a common casting-track and the cars of the molds for the ingots of both cranes therefore run on the same track. The result of this arrangement is that in case of a breakage of a mold-car or of a mold or the derailment of a car or displacement of a mold the entire converting room or section of the plant will be thrown out of operation, because it is utterly impossible to fill the ingot-molds and remove them, owing to the blockading of the common track from the accident, whatever its nature may be.

The object of our invention is to overcome this serious defect and other difficulties in the operation of steel plants as regards handling the molten material between the converters and the ingot-molds, and this we accomplish by constructing, locating, and arranging the converters, casting-cranes therefor, and pouring-tracks for the cranes so that it is practically impossible to throw the converter portion of the plant entirely out of operation, except by preventing the operation of the casting-cranes or the pouring-tracks at the same time, which rarely, if ever, will occur.

The invention consists in the novel construction, arrangement, and operation of the casting-cranes and the pouring-tracks in their relation to the converting vessels and to each other, respectively; and it consists, further, in the features of construction and combination of parts hereinafter described and claimed.

It is not deemed advisable in illustrating our invention to fully show the entire converting house or section of a steel plant in every detail, and therefore the house is shown in outline only, with the mechanisms and the arrangements thereof which relate particularly to our improvement inside the outline. It is only deemed necessary also to fully describe in detail such of the appliances and their relative construction and arrangement as enter into our invention and improvement.

In the drawings, Figure 1 is a top or plan view with the walls of the house or building in outline, showing three converters served by two receiving or serving cranes and two casting-cranes of the mast-and-boom order and showing the construction and relative arrangement of the casting-cranes and pouring-tracks which enter into the construction of our invention; Fig. 2, a longitudinal sectional elevation showing the casting-cranes in position to serve each its respective track and the car and mold on each track. Fig. 3 is a similar view of Fig. 1, showing overhead traveling cranes instead of mast-and-boom cranes for handling the casting-ladles; and Fig. 4, a longitudinal sectional elevation of the overhead traveling cranes and arrangement of Fig. 3 looking in the direction of the arrow.

It is to be understood that in carrying out our invention the building or house containing the several operative parts or appliances is to be of the necessary and suitable construction for the reception and operation of the parts. This building or house is to have suitably located therein a series of converters, preferably arranged in divisions, each division containing three converters A, B, and

C. The converters are in line one with the other, and each converter is of the usual construction, having its vessel mounted in a frame and adapted to be tipped in any usual and well-known manner of setting up and operating converter vessels. Each division of three converters is to be served, preferably, by two receiving-cranes D and E in the arrangement shown in Figs. 1 and 2. The crane D is located so that its pivotal mast or post D^2 is midway between the vessels A and B for its ladle D′ to coöperate with both of the vessels A and B, according as the crane is swung into position for its ladle D′ to receive the molten material from the vessels, respectively. The crane E is located so that its pivotal mast or post E^2 is midway between the converter vessels B and C for its ladle E′ to coöperate with both vessels B and C, according as the crane is swung into position for its ladle to serve either the vessel B or the vessel C. The crane D operates in conjunction with a casting-crane F, the pivotal mast or post F^2 of which is located in such relation to the pivotal mast or post of the crane D as that the ladle D′ can transfer the molten material carried thereby to the ladle F′ when the two cranes are in line, with the ladle F′ beneath the ladle D′, as shown for the cranes and ladles E′ and G′. The crane E operates in conjunction with a casting-crane G, the pivotal mast or post G^2 of which is properly located for the ladle G′ to receive the molten material from the ladle E′ when the cranes are in line, as shown in Fig. 1, with the ladle E′ above the ladle G′.

It will be noticed from an inspection of Fig. 1 that the carrying or pivotal mast or posts F^2 and G^2 are not in line with each other transversely, but that the mast or post G^2 is further advanced in its relation to the converter vessels than is the mast or post F^2, which arrangement sets the masts or posts of the two cranes F and G off centers or out of transverse alinement with each other. This setting of the masts or posts at off centers necessitates a greater length for the crane G than for the crane F in the arrangement shown in Figs. 1 and 2, though either crane could be the longest, so that the circle described by the ladles of the two cranes do not have the same radii. The radii of the crane G, as shown, and consequently its reach, is an increased one as compared with the radii and reach of the crane F, though the cranes D and E have the same radii and reach for each in use. The crane G, therefore, has its ladle G′ serving the ladle of the crane E in the same transverse line as the serving of the ladle of the crane D by the ladle F′ of the crane F; but the delivery from the casting-ladles F′ and G′ is at different points in relation to each other, the ladle G′ having a delivery farther in advance or farther away from the converters than the ladle F′.

The delivery or pouring of the ladles F′ and G′ at different points, one in advance of the other, enables two pouring-tracks H and I to be located separate and distinct from each other, one track H for the ladle F′ and the other track I for the ladle G′. This arrangement and location of the pouring-tracks permit the cars and ingot-molds for the respective casting-ladles to be operated without the cars and molds of the one track interfering in any way with the cars and molds of the other track in the handling of the cars and molds of the respective tracks. This results in effect in providing two separate, distinct, and independent means for casting and disposing of the ingots, comprising a division of converters, two receiving-cranes, and two casting-cranes in pairs, each pair consisting of a receiving and a casting crane, the two pairs operating each independently of the other, with the cranes of both pairs working together in the transmission of the molten material between the converter vessels and the casting-molds. It will thus be seen that the cars and the casting or ingot molds for the track H can be operated entirely independent of the cars and the casting or the ingot molds of the track I, so that in case of any accident to a car or mold on one track such accident would not interfere with the operation of the cars and molds on the other track. The track I and its cars and molds would be served by the cranes E and G from the vessels B and C even though the cranes D and F were thrown out of use by loss of operation on the track H, and the track H and its cars and molds would be served by the cranes D and F from the vessels A and B even though the cranes F and G were thrown out of use by loss of operation on the track I. It is not, therefore, necessary to shut the entire converting plant down, as would have to be done if the casting-cranes were in line and both served to a common track and that track should become disabled or thrown out of use from any cause. This is a great advantage in the operation of steel plants, as it enables the production of the ingots to be carried on even if one set of cranes and ladles is thrown out of use from any cause, either from the disabling of the cranes by breakage or otherwise or the stoppage of the cars and molds on a track from any cause.

Another advantage which results from the provision of having the casting-cranes deliver at different points in relation to each other and onto different pouring-tracks is that the molds and cars of one track are movable on separate lines, so that the operators of the crane F and track H on their platform J will not be subjected to the intense heat of the full molds from the crane G, as such molds are on the track I and can be moved past the platform J and out of the way on such track, which would not be the case if the crane G served its casting or ingot molds on the same track H.

It is well known that where two cranes pour into their respective casting or ingot molds

on the same track and the cars of such molds are moved out of the way in the same direction, as necessarily must be the case, the stoppage of a car from the crane G, moving in the direction of the crane F, would subject the operators of the platform J not only to the heat of the molds and metal of the crane F, but to the additional heat from the molds of the crane G. This is an objectionable feature in the operation of converting plants under the present system of working such plants and is overcome by our invention of providing independent tracks for the respective casting-cranes.

Each casting-crane is to have its independent slag-track, the crane F having the slag-track H′ adjacent to the pouring-track H, and the crane G having its slag-track I′ adjacent to its pouring-track I, so that the two tracks H′ and I′ will receive the slag from the ladles F′ and G′, respectively.

It is to be understood that the complete plant is provided with the usual pouring-platforms J and J′ for the two casting-cranes and is also to have the usual operating-platforms for the receiving-cranes and for the casting-cranes; but such platforms are not fully shown nor described in detail, as they may be of any usual and well-known form of construction and arrangement. The other appliances which are employed in a converting plant are also to be provided—such as vessel-runners, ladle-crane and operating-platform therefor, car-movers, ladle-dumping cylinders, platform for operating the blast-tipping vessels and the pouring of the receiving-crane, and the other devices commonly found and used in converting plants and which being of any usual and well-known form of construction need not be specifically described or illustrated.

The operation will be readily understood from the foregoing description and arrangement of the several appliances. The converters A and B are served by the crane D and its ladle, and such crane transfers the molten material to the crane F and its ladle for the ladle to pour or run the material into ingot-molds on cars operated on the track H. The crane E serves the vessels B and C for the ladle of such crank to transfer the molten material to the ladle of the crane G and have such ladle pour or run the material into the casting or ingot molds on cars operated on the track I. The two sets of crane serve the same converters, each serving two; but the service after the reception of the molten material by the ladles of the cranes D and E is continued at different points and in the different relations as to the final pouring and disposition of the cast ingots.

Each receiving-crane and each casting-crane has its own ladle, by which arrangement it is not necessary to change ladles from one crane to the other, as has heretofore been the practice. This provision of a separate ladle for each crane gives an additional ladle for use, which is of great advantage in increasing the facility, rapidity, and ease of handling the molten material between the converter vessels and the molds, as it does away with the necessity of wasting time in transferring the ladles. The construction of cranes, however, may be one, and the manner of pivotally mounting the ladles on the cranes may be such as to enable the ladle of the one crane to be transferred to the ladle of its companion crane, by which arrangement in case of a breakage or displacing of a ladle from any cause the operation of the cranes will not be interrupted during the time required for replacing the broken or disabled ladle or for any other cause.

Instead of employing mast-and-boom transporting-cranes an overhead traveling crane can be utilized for carrying the casting-ladles from the converters to the pouring-tracks, and an arrangement of overhead traveling cranes for this purpose is illustrated in Figs. 3 and 4. The main carriage L of each overhead traveling crane runs on tracks K therefor, located outside of the space occupied by the converters and pouring-tracks, and the trolley or carriage M, which runs on the main frame or carriage, is provided, as shown, with a chain having the pouring-ladle attached thereto and by which the ladle can be raised and lowered as required. The overhead traveling cranes, two of which preferably are used, each serves a desired number of converters, and one crane delivers its ladle for pouring on one of the tracks while the other crane delivers its ladle for pouring on the other track, and it will be understood that either crane can serve either track, as may be desired, and, if necessary, one crane could serve both pouring-tracks. The converters can be arranged in series of three or more for service by each of the cranes, or a greater or less number of converters can be served by either or both cranes, the cranes having a travel the full length of the line of converters. The cars, with their molds, are operated on an independent and distinct track for each overhead traveling crane and the cranes, the pouring-ladles, and the cars with molds are handled in the same manner and on the same plan as already described for the mast-and-boom cranes; but with the overhead traveling cranes a greater range of operation can be attained than with a mast-and-boom crane adapted to serve only three converters and two tracks, as the overhead traveling crane need not necessarily be confined for use with only three converters and two tracks.

What we claim as new, and desire to secure by Letters Patent, is—

1. The combination of a plurality of converter vessels, arranged in groups, receiving-cranes each operative with a group of the converter vessels, and casting-cranes, one for each receiving-crane and coöperative therewith and having their pivotal masts or posts at different fixed distances from the pivotal posts

of the receiving-cranes with which they coöperate for the pouring-cranes to pour at different points in relation to the converter vessels, substantially as described.

2. The combination of a group of converters comprising three vessels, two receiving-cranes jointly serving the three vessels, and two casting-cranes, one for each receiving-crane, one casting-crane having its pivotal mast or post at a greater distance than the other from the pivotal post of the receiving-crane operating therewith for the two casting-cranes to pour at different points in relation to the converter vessels, substantially as described.

3. The combination of a group of converters comprising three vessels, two receiving-cranes jointly serving the three vessels, two casting-cranes, one for each receiving-crane, one casting-crane having its pivotal mast or post at a greater distance than the other from the pivotal post of the receiving-crane operating therewith, and two independent pouring-tracks, one for each casting-crane, each track operative only in connection with its particular casting-crane, substantially as described.

4. The combination of a group of converters comprising three vessels, two receiving-cranes jointly serving the three vessels, each crane having its own ladle, two casting-cranes, one for each receiving-crane, each casting-crane having its own ladle and one casting-crane having its pivotal mast or post at a greater distance than the other from the pivotal post of the receiving-crane operating therewith for each set of cranes to be independently operative of the other set and both sets conjointly operating in serving the division of converters, substantially as described.

5. The combination of two receiving-cranes, two casting-cranes, one for each receiving-crane, one casting-crane having its pivotal mast or post at a greater distance than the other from the pivotal post of the receiving-crane operating therewith, and two independent pouring-tracks, one for each casting-crane for conducting the pouring operation at different distances from the converter vessels, substantially as described.

6. The combination of a group of converters comprising three vessels, two receiving-cranes jointly serving the three vessels, two casting-cranes, one for each receiving-crane, one casting-crane having a greater radius of action than the other and having its pivotal mast or post at a greater distance than the other from the pivotal post of the receiving-crane operating therewith, a separate and independent pouring-track for each casting-crane, and cars with casting or ingot molds thereon separately movable on the two independent pouring-tracks, substantially as described.

CHARLES H. McCULLOUGH, Jr.
LEONHARD C. B. HOLMBOE.

Witnesses:
EPHRAIM BANNING,
SAMUEL W. BANNING.

Correction in Letters Patent No. 697,740.

It is hereby certified that in Letters Patent No. 697,740, granted April 15, 1902, upon the application of Charles H. McCullough, jr., and Leonhard C. B. Holmboe, of Chicago, Illinois, for an improvement in "Bessemer-Steel Plants," an error appears in the printed specification requiring correction, as follows: The word "Ohio," line 6, page 1, should be stricken out; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of April, A. D., 1902.

[SEAL.]

F. I. ALLEN,
Commissioner of Patents.