Sept. 17, 1940. A. H. JUNG ET AL 2,215,043

METAL FEEDING APPARATUS

Filed April 4, 1940 3 Sheets-Sheet 1

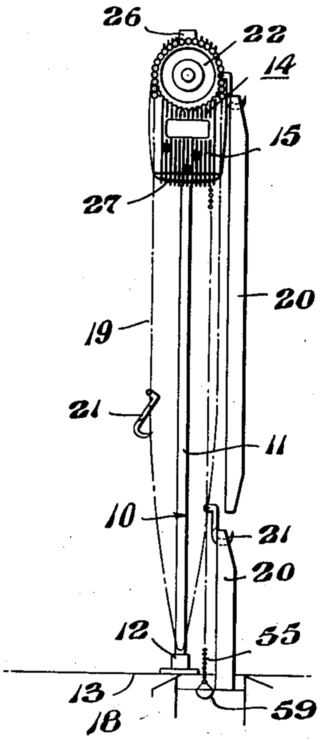

Fig. 1.

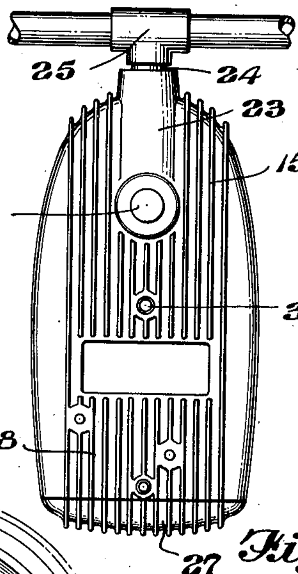

Fig. 2.

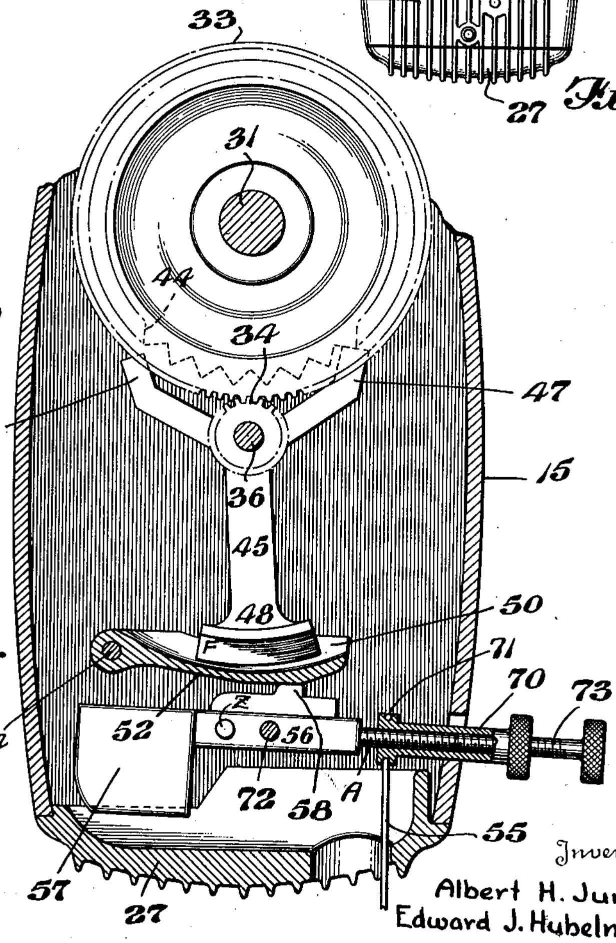

Fig. 5.

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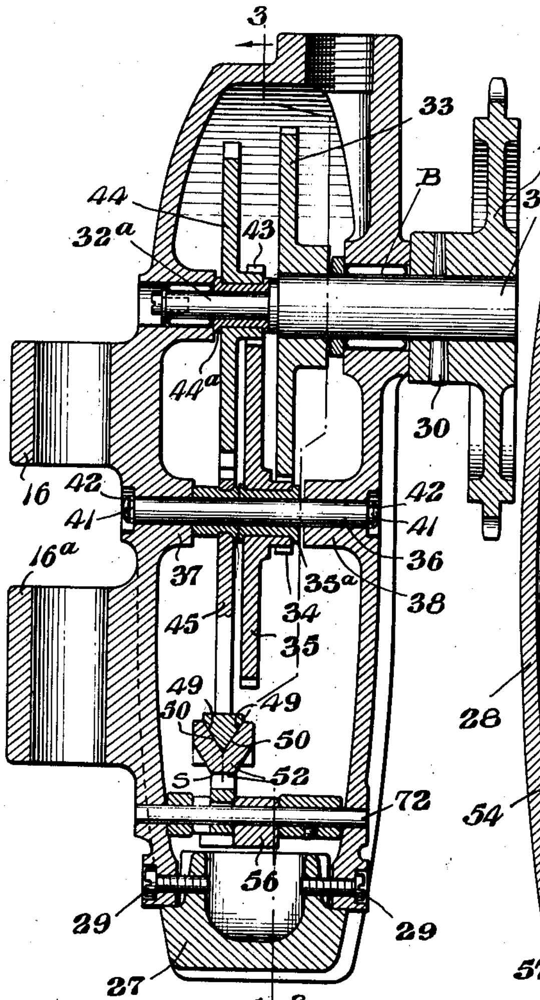

Fig. 4.

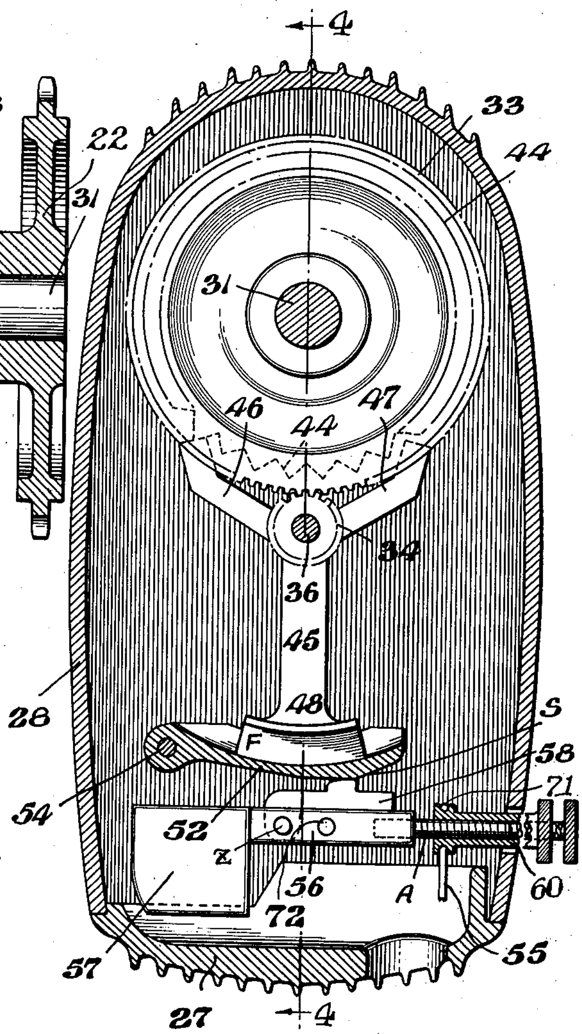

Fig. 3.

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Fig. 6.

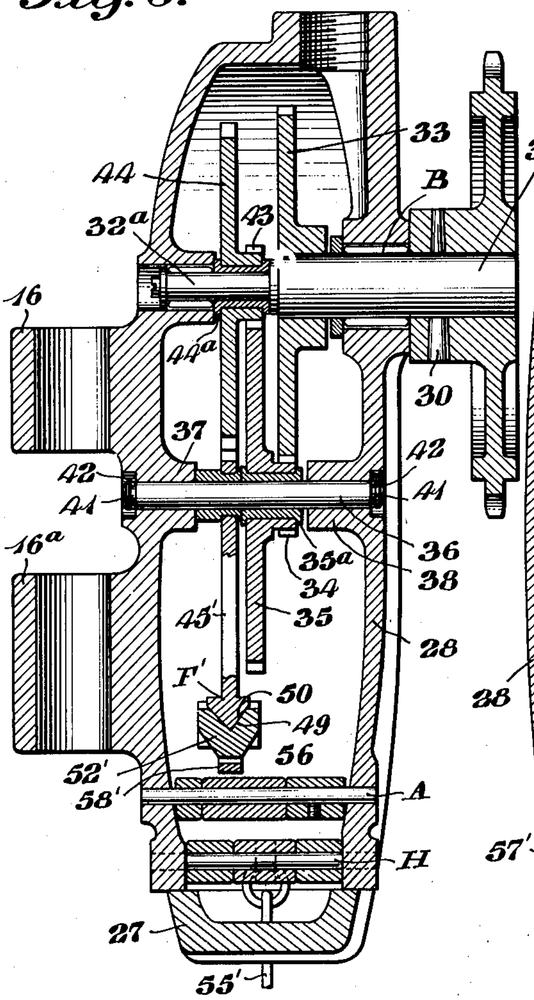
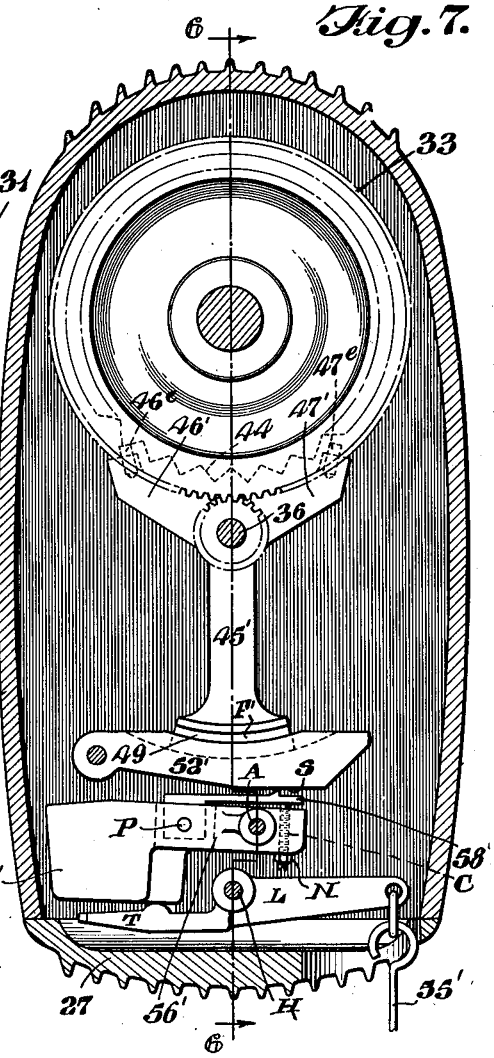


Fig. 7.



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METAL FEEDING APPARATUS

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Application April 4, 1940, Serial No. 327,880

6 Claims. (Cl. 22—80)

This invention relates to metal feeders and more particularly to automatic feeders for lowering metal ingots into a melting pot.

This application is a continuation in part of our copending application Serial No. 299,203 filed October 12, 1939.

Prior known devices and methods involve the lowering of an ingot hooked to a single strand or chain into a melting pot and some stop device for causing cessation of operation of a feeder when a predetermined level has been reached in said melting pot. These prior devices and methods have been found to be generally unsatisfactory in that the feeding is non-continuous for when the melting pot demands molten metal the use of but a single strand or chain requires rewinding of same before an additional ingot can be associated with the feeder. Some prior feeders have incorporated two or more feeder strands or chains in order that the feding of the metal to the bath may be more or less continuous. These additional feeder chains increase the expense of manufacture requiring great duplication of parts and have prevented the wide use of such multiple chain feeders for the additional cost of these machines has not been conducive to their installation.

In our copending application Serial Number 299,203 filed October 12, 1939, we propose the installation of an endless chain in association with a metal feeder whereby feeding may be more or less continuous, corresponding to the demand and obviating the necessity for the rewinding of the chain before additional ingots may be associated with the feeder. To control the device in the said copending application to feed metal only when the level in the melting pot is below a predetermined level, a friction brake device has been provided. While this arrangement has been found to operate under special conditions, yet under greatly varying loads the control was not quite satisfactory. During that portion of the feeding cycle in which the ingot is at the top of the feeder, a great load is imposed on the device; and during that portion of the cycle in which the ingot has almost reached the bottom of the device with most of the said ingot melted, the weight of the ingot has been considerably diminished with corresponding decreases of motivating force. Under such varying conditions of motivating force, prior feeders have been found wanting in that their control is irregular and generally unsatisfactory. Accordingly, special controls, arrangements, and a specific brake mechanism are set forth in the instant application which are improvements over prior devices.

It is an object of the instant invention to provide a metal feeder of simple construction, inexpensive to manufacture, and capable of satisfactory control under varying load conditions.

It is a further object of the instant invention to provide a continuous feeder having a controller for regulating the action of the apparatus while in operation and in addition an arrangement for causing cessation of operation when the demand for molten metal has been satisfied.

It is a still further object of the instant invention to provide a continuous feeder having a controller for regulating the action of the apparatus while in operation, and in addition a specific brake mechanism for effecting brake action on said controller.

Other objects and the nature and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a view in elevation of the feeder device in operation and illustrating one manner in which the device may be mounted;

Fig. 2 is a view in elevation of the feeder mechanism casing and illustrating a second mode of mounting;

Fig. 3 is a view in section of the feeder head taken along line 3—3 of Fig. 4 with gear wheel 35 removed, and looking in the direction of the arrows;

Fig. 4 is a vertical section of the feeder head taken along line 4—4 of Fig. 3 and looking in the direction of the arrows; and

Fig. 5 is a fragmentary sectional view similar to Fig. 3 with the operating parts in a different position.

Figs. 6 and 7 are similar to Figs. 4 and 3 but depict a modified form of the invention.

Referring to Fig. 1, a stand 10 comprises a vertical supporting leg 11 which may be fabricated of ordinary piping and mounted in a socket 12 secured to a base 13 in any suitable manner so as to effect a stable support for the feeder mechanism 14. The ribbed casing 15 of the feeder mechanism 14 is provided at its rear, see Fig. 3, with a pair of tubular engaging elements 16 and 16*a* which are adapted to be associated with a cylindrical support such as the leg 11. Bolts, not shown, may be utilized to firmly secure the feeder mechanism 14 to the supporting leg 11 of the stand 10.

When first mounting the feeder mechanism

14 in alignment with the upper end of the melting pot 18 it may be found necessary to more or less adjust the height of the mechanism above the melting pot to accommodate the length of feeder chain 19; the longer the chain the more ingots 20 it may receive upon the hooks 21 associated with the said chain 19. This adjustment as to height may easily be made by sliding the tubular elements 16 and 16*a* of the casing 15 along the supporting leg 11 until the precise height desired is ascertained, at which time bolts or other suitable fastening means may be made fast.

Not only may the feeder mechanism be supported at its rear, as shown in Fig. 1, but it may be suspended from its top portion, as illustrated in Fig. 2. In this view the sprocket wheel 22 has been removed to better depict the formation of the upper portion of the casing 15. The vertically extending protruding formation 23 at the upper portion of the casing is tapped to receive either a nipple 24 which in turn may be associated with a horizontal support 25 or it may receive a cap 26 such as shown in Fig. 1. When the feeder mechanism is supported at its rear as shown in Fig. 1, then the cap 26 is associated with the tapped protruding portion 23 of the casing 15. The lower portion of the casing 15 is provided with a removable part 27, which lower part includes upwardly extending walls which overlie a portion of the inner wall of the main body section 28 of the casing 15, see Figs. 3, 4 and 5. The screws 29, see Figs. 2 and 4, serve to securely hold the lower portion of the casing 27 to the main body section 28 of the casing 15.

Referring to Figs. 3 and 4, the sprocket wheel 22 is locked by means of a pin 30 to the shaft 31 supported by the bushing B in the casing 15. The relatively large gear wheel 33 is secured to the shaft 31 within the casing 15 and engages the relatively small gear wheel 34 which is formed integral with the relatively large gear wheel 35. The gear wheels 34 and 35 are mounted on a bushing 35*a* and form a unit which rides freely on the shaft 36, the ends of which shaft engage the inwardly projecting portions 37 and 38 of the casing 15. Each outer end of the shaft 36 is formed with a circular groove 41, and after assembly of the said shaft with the casing 15, ring-like spring members 42 are slipped into the grooves 41 to securely hold the shaft in place.

The gear wheel 35 engages the relatively small gear wheel 43 which is formed integral with the relatively large gear wheel 44. The gear wheels 43 and 44 together with the bushing 44*a* form a unit which rides freely on the portion 32*a* of the shaft 31, which portion 32*a* is of less diameter than that portion of the shaft 31 to which the large gear wheel 33 is fixed. The teeth of the gear wheels 33, 34, 35 and 43 intermesh and are of corresponding size. The teeth on gear wheel 44, however, are relatively large, have straight sides and relatively sharp corners, as illustrated in Figs. 3 and 5 for example. It is to be understood that the form of teeth recited are illustrative of what may be utilized, but other forms may be incorporated in the construction without departing from the spirit of the invention.

Riding freely on the shaft 36 is the escapement rocker control mechanism 45 having two upper arm portions 46 and 47 respectively, which are adapted to alternately engage the teeth of the gear wheel 44. The leg portion 48 of the rocker control 45 comprises a foot F of triangular section, see Fig. 4, the V surfaces 49 of which are adapted to be engaged by the corresponding V surfaces 50 of the brake lever 52. The brake lever 52 is pivotally mounted on a shaft 54 and when rotated in a counter-clockwise direction, serves to effect wedge-like engagement of the V surfaces 49 of the foot F of the leg 48 of the rocker control 45.

The brake lever 52 being pivoted at one end, it is normally out of engagement with the surfaces 49 of the rocker control 45 and the tension of the float chain 55 is relieved, permitting the float lever 56 to rotate in a counter-clockwise direction by reason of its relatively heavy end 57. Formed on or pivotally or otherwise secured to the operating lever 56 is the cam 58 which engages the lower surface S of the brake lever 52 when the float lever 56 is rotated in a counter-clockwise direction. The cam 58 may be adjustably positioned with respect to the operating lever 56 by an adjusting screw when the cam 58 is pivoted at "Z" to the lever 56. The heavy end 57 of the float lever 56 has an extension 60 which is secured to the threaded adjustment rod A. A float 59 is secured to the lower end of the float chain 55, see Fig. 1, and serves to relieve the tension on the said float chain when the level of molten metal within the pot 18 is at a predetermined maximum, and further serves to provide tension on the said float chain when the molten metal is below this level. The weighted end 57 of the float lever 56 and float 59 are correlated so that smooth operation of the brake mechanism described may be effected. To provide for whatever adjustment is necessary in connection with the action of the weight 57, a tubular adjusting nut 70 is associated with the adjusting rod A in such relation that the ring-like end 71 of the chain 55 may be moved closer to or away from the shaft 72 about which the float lever 56 oscillates. Locking screw 73 is associated with the threaded interior of the adjusting nut 70 whereby locking action may be applied between the adjusting rod A and the adjusting nut 70. As will be readily understood movement of the ring-like end 71 closer to or away from the shaft 72 serves to change the effective length lever arm for the float 59, thereby providing for nicety of adjustment on the control for the feeder mechanism.

The hooks 21 are pivotally secured to the continuous sprocket chain 19, as shown in Fig. 1, in order to prevent distortion of the chain by the hooks flopping over in their upward travel while at the same time proper pivotal action of the hooks in their downward travel takes place during operation of the mechanism to feed ingots to the melting pot 18.

With the feeder device installed over the melting pot and secured thereabove as illustrated in Fig. 1, and with an ingot 20 associated with the hook 21 on the continuous sprocket chain 19, the sprocket wheel 22 will be caused to rotate in a clockwise direction effecting the turning of the shaft 31, see Fig. 4, to which shaft 31 is secured the relatively large gear 33 which engages the relatively small gear wheel 34 which rides freely on the shaft 36. Rotation of the relatively small gear wheel 34 effects corresponding rotation of the relatively large gear wheel 35 which is formed integral with the wheel 34. The gear wheel 35 engages the relativel ysmall gear wheel 43 which rides freely on the shaft 31 and which is formed integral with the relatively large gear wheel **44** which has relatively large teeth of a configuration best illustrated in Figs. 3 and 5.

Oscillating freely with respect to shaft **36** is the rocker control **45**, one arm of which, either the arm **46** or the arm **47**, is always in engagement with one of the relatively straight sided teeth of the gear wheel **44**. In Fig. 3 the arm **46** is in engagement with a tooth of the gear wheel **44** and the arm **47** is free, whereas in Fig. 5 the arm **47** is in engagement with a tooth of the gear wheel **44** and the arm **46** is free. It will be readily apparent, with this construction, that the feeder apparatus is prevented from running away by one of the arms, either the arm **46** or the arm **47** of the rocker control **45**, acting as a check on the gear system described, whereby even though the weight of the ingot **20** urges rotation of the feeder gear system, yet it is held back. This urge in rotation does actually cause movement of the rocker arm **46**, see Fig. 3, out of engagement with the engaging tooth of the gear wheel **44**. As soon as disengagement of the arm **46** is effected, however, the arm **47** immediately engages as illustrated in Fig. 5. It will now be understood that the train will operate by virtue of the weight of the ingot **20** in association with one side of the feeder chain **19** but that the rotation of the mechanism will be checked or controlled by the arms **46** and **47** of the rocker control **45**.

Cessation of the operation of the feeder system takes place when the melting pot is satisfied, for when there is enough molten metal within said melting pot, the float **59** therewithin will be at a height to effect slack within the chain **55** or at least relieve the tension therein whereupon the weighted end **57** of the float lever **56** will cause rotation of the latter in a counter-clockwise direction starting from the position depicted in Fig. 5 and ending in the position shown in Fig. 3 so that the cam **58** will act upon the brake lever **52** to effect its counter-clockwise rotation about the shaft **54** and cause the V surfaces **50** to engage with wedge-like action the V surfaces **49** of the foot F of the rocker control **45** and prevent further oscillation thereof. As one of the arms **46** or **47** of the rocker control **45** is always in engagement with a tooth of the gear wheel **44** of the feeder gear train system, a lock is effected and further feeding is prevented.

In Figs. 6 and 7 a modified form of check control and brake including a compound leverage system and novel adjusting device is depicted. The rocker control **45'** which oscillates freely with respect to the shaft **36** includes arms **46'** and **47'**, respectively, each of which are bored in their top faces to receive the wearing elements **46e** and **47e**, respectively, which cooperate with the teeth of the gear wheel **44** to effectively check the rotation of the said gear wheel as already described in connection with Figs. 1 to 5 inclusive.

When the level within the melting pot has reached a predetermined maximum, the float **59** therein will be at a height to effect slack within the chain **55'** or at least relieve the tension, whereupon the lever L which is weighted on that side T of the shaft H which is opposite to the connection of the float chain with the lever L, and the lever L will rotate in a counter-clockwise direction and permit the lever **56'** to rotate in a counter-clockwise direction about shaft A under the influence of the weighted end **57'** which is released by the rotation of the end T of the lever L away therefrom. The free counter-clockwise rotation of the lever **56'** brings the actuating cam **58'** into contact with the bottom side S of the brake lever **52'** whereupon the V-shaped brake surface **50** makes frictional contact with the corresponding V-shaped brake surface **49** on the foot F' of the oscillating rocker control **45'**.

To provide for adjustment of the compound leverage system associated with the brake lever **56'**, the screw C is secured to the lower side of the cam **58'**, extends through the lever **56'**, and is engaged by an adjusting nut N at its outer end. The cam **58'** is pivotally secured at P to the lever **56'** whereby rotation of the adjusting nut N will affect the distance between the working end of the cam **58'** and the lever **56'** so that precise and effective braking action occurs in response to the level of molten metal within the melting pot.

With this construction, the actuation of the lever **56'** by its weight end **57'** is independent of the incidental weight of the level response means which includes the float within the melting pot, the chain **55'**, and the lever L. Accordingly, under all conditions of operation, constant and proper braking effect will be applied to the rocker control **45'** which is capable of adjustment by the nut N which may be adjusted at the factory prior to the installation of the feeder mechanism and no adjustment is necessary for different lengths or weights of feeder chain or level responsive equipment.

Not only may counter-clockwise rotation of the sprocket wheel **22** be effected but reverse rotation may be caused by removing the chain **19** from the sprocket wheel and reapplying it to the sprocket wheel **22** in reverse arrangement, that is, with the left side now on the right and former right side now on the left. This will place the hooks **21** in such position as to receive ingots **20** on the left side of the feeding apparatus instead of on its right as illustrated in Fig. 1. The teeth of all the gear wheels in the feeder gear train being symmetrical, the machine will operate in reverse direction as well as that which corresponds to clockwise rotation of sprocket wheel **22**. This versatile feature of the device permits the feeder apparatus to be associated with machines of such a nature other than those that can only operate properly with feeders lowering ingots from their right sides and which have their sprocket wheels rotatable only in a clockwise direction.

It has been found in practice that the mechanism described operates to lower metal into a molten bath in a desirable manner, despite variance in weight applied to one side of the feeder chain. For example, under conditions of operation wherein the feeder chain is loaded by weights varying from two complete ingots down to the weight of but a single ear of an ingot, the feeder mechanism satisfactorily fed metal to a pot and properly responded to the float control. The float controlled brake effectively suspended operation of the machine when the melting pot was satisfied, though the weight of two whole ingots urged movement thereof, and further, the feeding of metal was not improperly retarded when the melting pot was not satisfied, though the weight of but a single ear of an ingot urged rotation of the sprocket wheel **22**.

Though desired operation may possibly be effected by a machine simply controlled by friction means under limited weight range conditions, yet such a construction is not satisfactory for association with line type casting machines operated under such capacity as necessitates relatively great variation in weight upon the feeder chain. Accordingly, the instant invention is an improvement over such machine in that it includes a control for checking movement of the feeding apparatus in addition to a braking mechanism involving a wedge-like action.

Those prior machines which rely simply upon a positive locking brake for control must of necessity be made so strong as to prohibit their manufacture at a reasonable cost conducive to universal acceptance. Should the parts of such a machine be made of reasonable size, that is, with the feeder gear train system limited to a volume suitable for use and association with a line type casting machine, the danger of breakage involving frequent servicing would be great. An undue pull upon the feeder chain of such suggested construction, such as the loading thereon of the weight of two full size ingots, would effect stripping of the gears, other locking mechanism or other engaging parts.

In the instant invention a construction is set forth which is a novel combination of feeder gear train, checking mechanism, and wedge-like brake associated with said mechanism, which permits the parts to be manufactured of reasonably small size and of ordinary materials yet provides for a delicate satisfactory control without fear of breakage because of hard usage or sudden great loading. The said checking mechanism may be denoted as a "check" control for in fact it delays or checks the activities of the gear train in a desirable manner to effect smoother operation of the feeder and facilitates accurate breaking as indicated by the level within the melting pot. As the checking mechanism is an oscillating member, it may also be termed a "dynamic speed checking mechanism." It is to be understood that where the term "check mechanism" is recited a positive brake is not denoted. By arranging the V shaped surfaces 49 and 50, as shown in the drawings, an effective wedge-like brake results which operates in the general combination shown in an effective manner, while at the same time critically reducing the size of the parts. The foot F of the rocker control 45 cooperates with the braking surfaces of the brake lever 52 to effectively cause cessation of operation of the said rocker control 45 in response to a high level within the melting pot.

It will be obvious to those skilled in the art that various changes may be made in this device without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. An ingot feeder comprising a frame, a conveying system and a braking system, said braking system including: V-shaped friction brake means pivotally supported by said frame and adapted to engage and disengage the conveying system, a weighted lever pivotally mounted on said frame, said weighted lever having pivotally mounted thereon an operator for coacting with said brake means, adjustment means on said lever to effect the rotation of said operator about its pivot point on the lever for changing the dimensional relation between said operator and said weighted lever, a float lever pivotally mounted on said frame and having a portion for engaging said weighted lever and a portion associated with the float, whereby when the float is raised the portion associated wtih the weighted lever will move away therefrom so that the weighted lever may rotate about its pivot under the action of the weight and cause the operator to coact with the brake means.

2. An ingot feeder including a frame, a conveyor system, and a float controlled brake system associated with the conveyor system, said brake system comprising: a brake lever pivotally mounted on said frame, a weighted lever pivotally mounted on said frame and associated with said brake lever, and a float operated lever pivotally supported by said frame, said levers being constructed and arranged so that the weighted lever effects the braking action on the feeder through the brake lever when the float lever is moved to its raised float position, said weighted lever acting on said brake lever independently of the float lever, and when said float is in lowered position said float lever acts to counteract said weighted lever, whereby the braking action ceases.

3. The structure recited in claim 2, and an operator for contacting said brake lever pivotally mounted on said weighted lever, and an adjustment means for causing said operator to pivot on said weighted lever to change the dimensional relation of the operator with respect to said weighted lever.

4. An ingot feeder including a frame, a conveyor system, and a float controlled brake system associated with said conveyor system, said brake system comprising: a brake lever pivotally mounted on said frame, a weighted operating lever pivotally mounted on said frame, an operator for contacting said brake lever pivotally mounted on said operating lever, adjustment means mounted on said operating lever for changing the position of said operator with respect to said operating lever, a float associated with said braking system for controlling the same, said adjustment means being operable to affect the float control of said braking system.

5. An ingot feeder including a gear train and a conveyor operatively associated with said gear train, a frame for supporting said gear train, a combined brake surface and escapement mechanism comprising a braking surface portion and a pair of escapement arms operatively connected to said gear train, said escapement mechanism being pivotally mounted on said frame for oscillatory movement with the pivot point between the two arms on the one hand and the braking surface portion on the other whereby the two arms may alternately engage and disengage said gear train, friction brake means adapted to selectively engage and disengage the said braking surface portion.

6. The structure recited in claim 5, said combined brake surface and escapement mechanism comprising a generally symmetrical Y-shaped member, the two arms of the Y forming the escapement arms and the leg of the Y forming the braking surface portion.

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