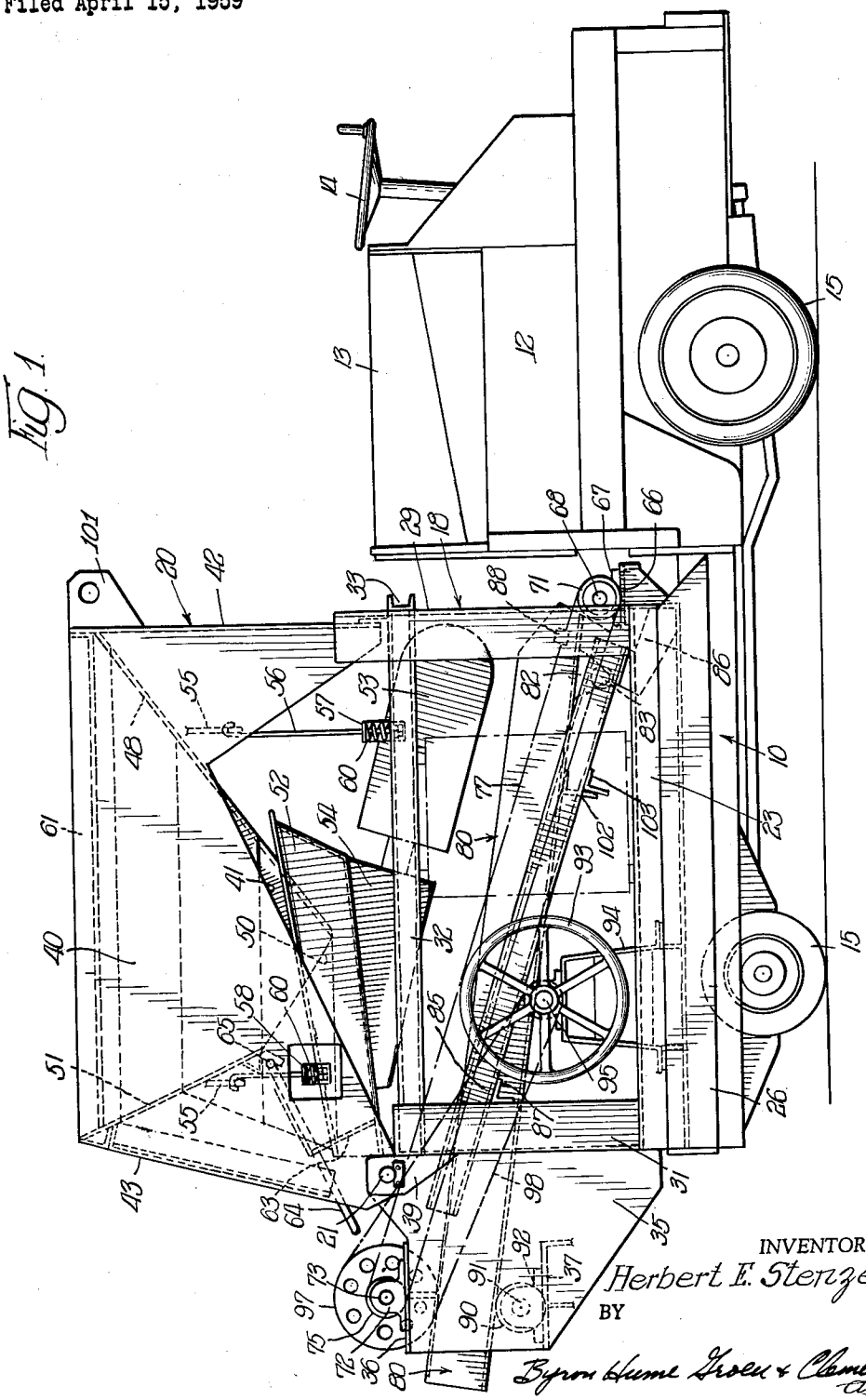
March 5, 1963 H. E. STENZEL 3,080,158

MOBILE LADLE ADDITION FEEDER

Filed April 15, 1959 4 Sheets-Sheet 1

Fig. 1.



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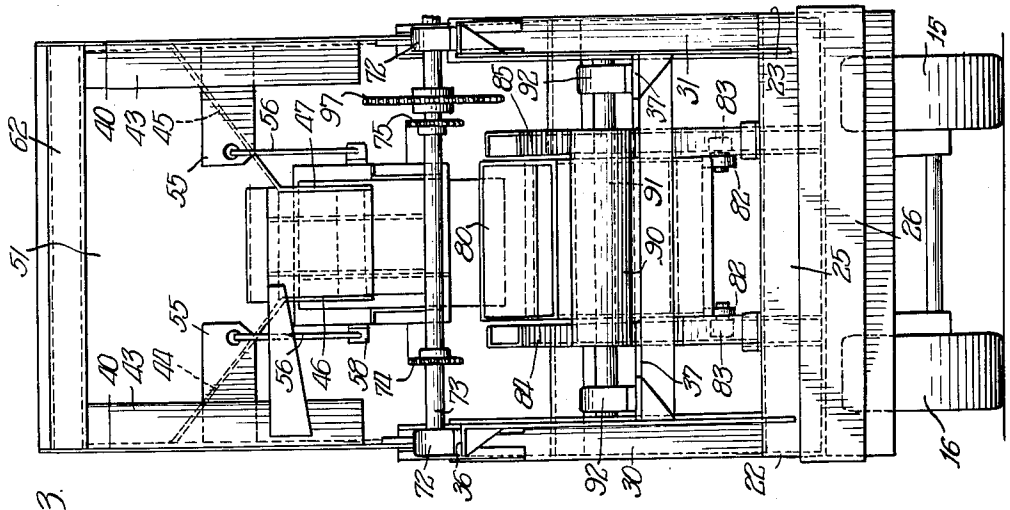


Fig. 3.

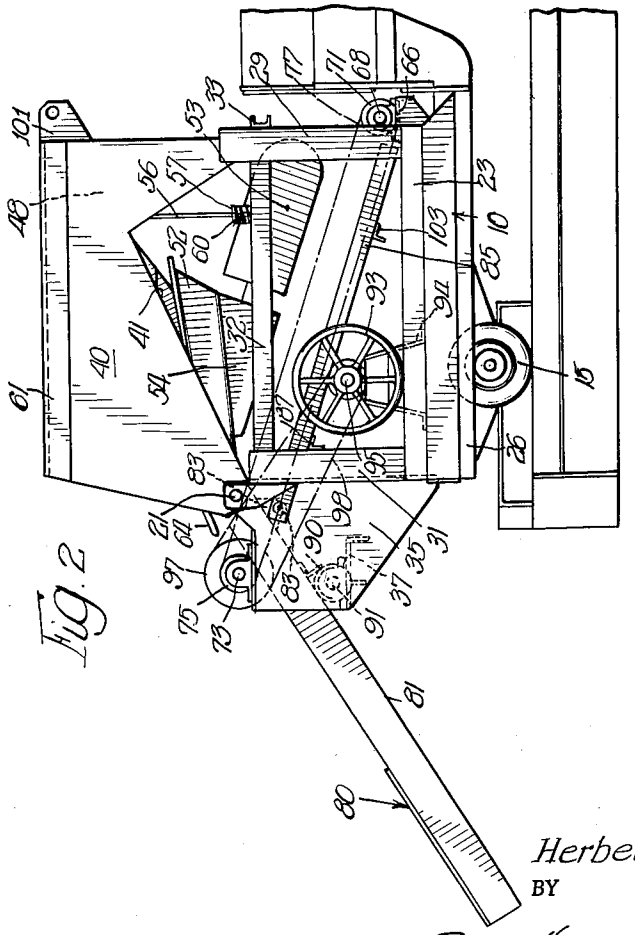


Fig. 2

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MOBILE LADLE ADDITION FEEDER

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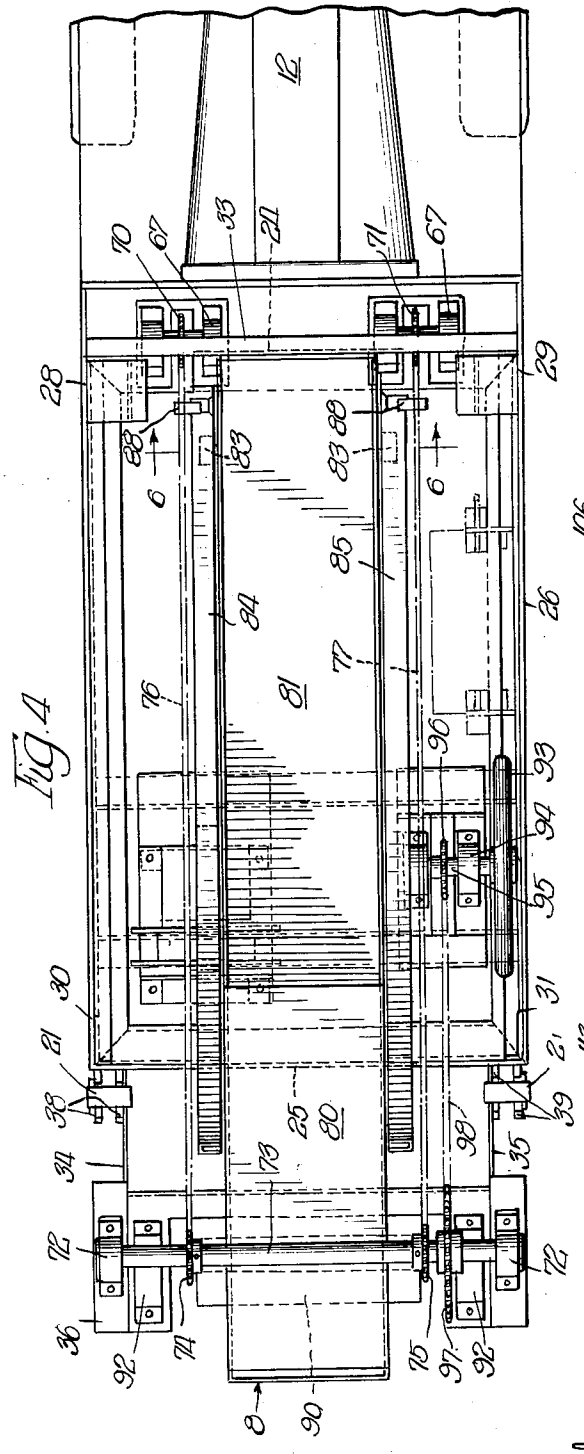


Fig. 4

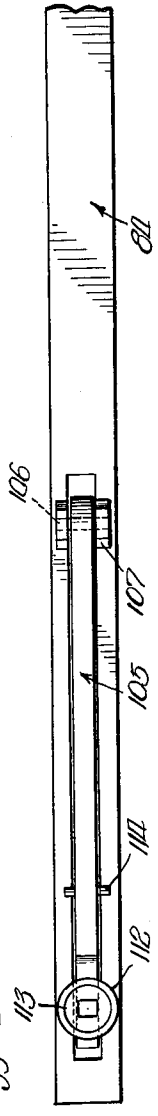


Fig. 7

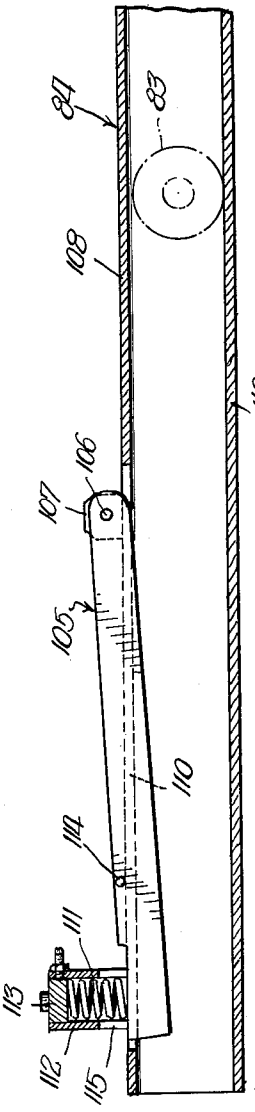


Fig. 8

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Fig. 5.

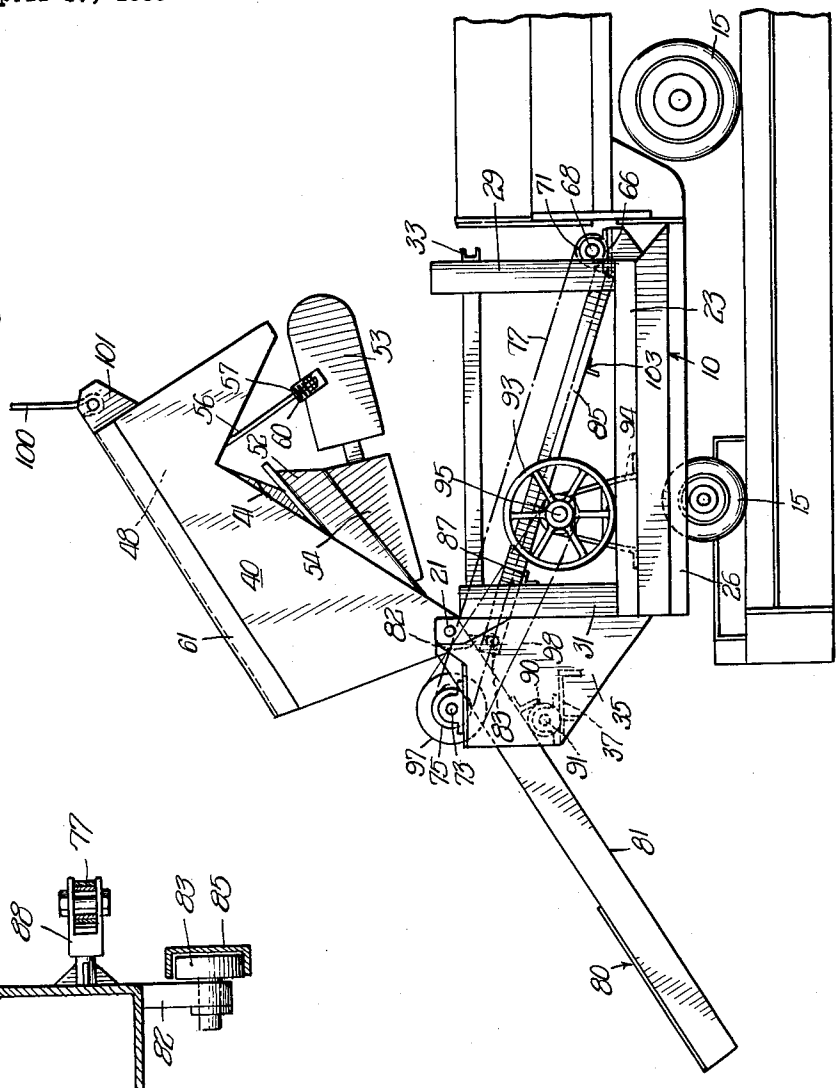
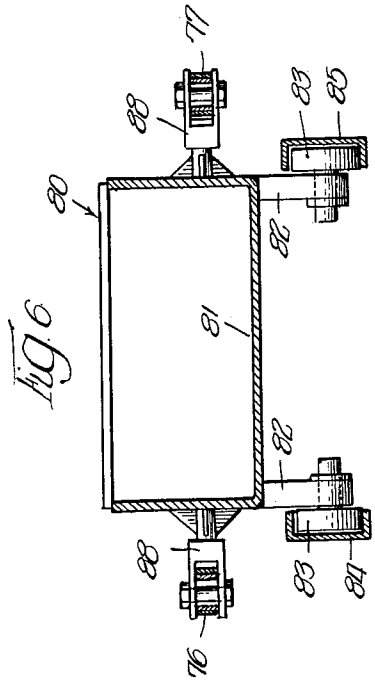


Fig 6



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3,080,158

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MOBILE LADLE ADDITION FEEDER

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Filed Apr. 15, 1959, Ser. No. 806,714
5 Claims. (Cl. 266—34)

The invention relates to feeders for adding solid material to molten metal and has more particular reference to ladle feeding units which are mobile, thereby permitting movement from furnace to furnace for adding the necessary additions to the ladle during the pouring operations.

In the manufacture of steel it is customary to add certain additional materials for alloying with the steel, such as, for example, alloys of manganese, and the steel is made to a rather specific requirement as to the percentages of such additional alloying materials. The physical and chemical specifications for such additional materials require that they be uniformly distributed throughout a heat which may comprise many tons of metal. Such additions are also quite costly and the apparatus for adding the materials must avoid waste of the materials if the structure is to be of practical and commercial importance.

An object of this invention is to provide a ladle addition feeding unit for use with metallurgical furnaces which will have the maximum mobility so that the unit can be positioned under storage bins for filling and then moved from furnace to furnace for adding the necessary additions of solid material to the ladle.

Another object is to provide a mobile feeding unit such as described, which will incorporate a delivery chute capable of reciprocating movements so that the chute can follow the ladle as it is moved during the pouring cycle. Also the chute can be retracted when necessary to clear the ladle.

Another object is to provide a mobile feeding unit having a reciprocable delivery chute which is guided by means of parallel extending track channels and which is projected and retracted by a manually actuated hand wheel through connecting roller chain mechanism.

A still further object is to provide a mobile feeding unit for delivering solid material by means of a chute mounted at the rear of the unit for projection from the rear and for retraction within the unit, and wherein the chute when retracted will be positioned below a vibrating feeder and within the length of the unit for the maximum compactness of the parts.

Another object is to provide a spring loaded snubber for the reciprocable chute of a ladle addition feeder whereby to frictionally snub and brake the movement of the chute as it approaches its extreme position in a projected direction.

Other and further objects will appear as the description proceeds;

In the drawings wherein like reference numerals designate like parts;

FIGURE 1 is a side elevational view of the mobile feeding unit of the invention, the reciprocable delivery chute being shown in retracted position;

FIGURE 2 is a fragmentary elevational view of the unit as illustrated in FIGURE 1, but showing the delivery chute in projected position and ready for delivering solid materials to a ladle, furnace or the like;

FIGURE 3 is an elevational view of the rear end of the mobile feeding unit looking toward the right in FIGURE 1;

FIGURE 4 is a top plan view of the feeding unit of the invention as illustrated in FIGURE 1;

FIGURE 5 is a side elevational view of the unit on a reduced scale and which illustrates the elevated inclined

position of the hopper and vibrating mechanism for emergency discharge in the event of a power failure;

FIGURE 6 is a transverse sectional view taken substantially along line 6—6 of FIGURE 4;

FIGURE 7 is a top plan view showing the frictional snubber for the reciprocable chute, and

FIGURE 8 is a vertical longitudinal sectional view of the snubber as shown in FIGURE 7.

Referring to the drawings and, in particular, to FIGURES 1, 2 and 3, it will be observed that the present feeding mechanism is mounted on the platform **10** of an industrial motor truck indicated in its entirety by the numeral **12** and which includes the hood portion **13** for the motor, the steering wheel **14**, and the supporting and travelling wheels **15** and **16** located adjacent the motor end and the feeding end of the unit respectively. The said unit includes a lower or base frame **18** and an upper or top frame **20**, the said frames being pivotally connected at **21**. The pivotal connection provides for movement of the top frame **20** to an elevated position as illustrated in FIGURE 5 for purposes which will be presently described.

FIGURES 1 and 2 show the base frame as consisting of longitudinal side members **22** and **23** joined to front and rear transverse members **24** and **25** to form the structural base for the lower frame **18** and which structural base is suitably secured to the platform **10** of the industrial truck by the longitudinally extending side plates **26**. The structural base is provided with a plurality of uprights, namely **28** and **29**, at the motor end, and **30** and **31** at the rear end. The uprights are located at the respective corners of the lower frame and it will be observed in FIGURE 4 that the uprights comprise angle members which are connected and structurally reinforced by the horizontally disposed channels **32** located adjacent each side of the frame and extending longitudinally thereof and by the channel **33** which extends transversley at the forward end of the frame. The rear uprights **30** and **31** have suitably secured thereto as by welding, the rearwardly extending brackets **34** and **35** and said brackets, in turn, have fixed thereto the bracket plates **36** and **37**. Each of the rear uprights **30** and **31** have also fixed thereto pivot brackets such as **38** and **39**, FIGURE 4, and which are spaced outwardly of its respective rearwardly extending bracket either **34** or **35**. The brackets such as **38** receive a pivot pin **21** and which is located on one side of the lower frame, whereas the brackets **39** also receive a pivot pin **21** but which is located on the opposite side of the frame. As previously stated the pivot pins **21** support the upper or top frame **20** which will now be described in detail.

Said top frame essentially consists of a pair of side plates identified by the numeral **40**, having a bottom opening **41** and which are connected at the front end of the frame by the front wall plates **42**, and at the rear of the frame by the rear wall plates **43**. A hopper is formed within the rectangular structure thus provided, see FIGURES 1 and 3, the same including the side plates **40** the diagonal side plates **44**, **45**, and which are continued in a downward direction by the side plate members **46** and **47**. At the front end of the upper frame **20** and connecting with front wall plates **42**, the hopper includes the diagonal wall **48** which extends downwardly so as to terminate below the discharge opening **50** of the hopper. Adjacent the rear wall plates **43** the hopper includes the diagonal wall **51**, the same terminating at the hopper opening. Feeding mechanism of the vibrating type is supported below the discharge opening **50** of the hopper, the same including the feeder pan **52** and the vibrating mechanism **53** which is connected to the underside of the pan by the bracket assembly **54**. The feeder pan assembly is supported from the upper frame by means of mem-

bers 55, the suspension rods 56 and the supporting ears 57 and 58. The ears 57 join the suspension structure at the front end of the frame to the vibrating mechanism 53, whereas the ears 58 join the suspension structure to the feeder pan 52 adjacent the rear end thereof. The suspension of the vibrating feeding mechanism from the upper frame is conveniently cushioned by the coil springs 60 associated with the ears 57 and 58, respectively.

The hopper structure located within the upper frame 20 may be reinforced around the upper edge thereof by the longitudinal and transverse plates, such as 61 and 62, respectively. The material within the hopper will flow by gravity into the feeder pan 52 and discharge of the material from the feeder pan is conveniently regulated by the gate 63 actuated by the handle 64, said handle being pivoted at 65 to a bracket depending from the diagonal rear wall 51. When the operator desires to deliver material to the reciprocating chute the vibrating mechanism 53 is energized to effect a vibrating motion of the feeder pan 52, and the operator then lifts the gate 63 whereupon the vibrating action of the pan will propel the solid materials to the rear of the pan, and which are accordingly discharged onto the chute for eventual delivery to the ladle. The lower frame, the reciprocating chute, and the endless chain mechanism for projecting and retracting the chute will now be described.

The uprights 28 and 29 are joined adjacent the structural base by means of transverse supporting plates 66, said plates, in turn, supporting the journaling means 67 for the shaft 68. Between the spaced journaling means 67, the shaft 68 is provided with a pair of spaced sprocket wheels 70 and 71, FIGURE 4. At the rear end of the feeding unit and supported by the bracket plates 36 there is located a similar pair of journaling means 72 and which journal the shaft 73. A pair of sprocket wheels 74 and 75 are fixed to shaft 73 in spaced relation and said sprockets are approximately the same size in diameter as sprocket wheels 70 and 71. The sprocket wheels on opposed shafts are adapted to support endless chain mechanism, and accordingly an endless chain 76 passes over the aligned pair of sprocket wheels 70 and 74. In a similar manner the endless chain 77 is operatively connected to the aligned pair of sprocket wheels 71 and 75.

The endless chain mechanisms are actuated for reciprocating a chute indicated in its entirety by numeral 80 and which is shown retracted in FIGURE 1 and projected in FIGURES 2 and 5. The bottom wall 81 of the chute is provided with depending lugs 82 which journal the rollers 83, FIGURE 6, said rollers having location within track channels 84 and 85 disposed on respective sides of the reciprocable chute 80. The track channels are disposed diagonally within the base frame 18, having their end at the front of the frame located adjacent the base structure, whereas the opposite end at the rear of the frame is located relatively close to but below the pivot pins 21. The brackets 86 are employed at the front end for fixedly securing the said end of the track channels to the base structure and in a similar manner channels 87 are employed for securing the rear end of the track channels to the rear uprights 30 and 31, respectively. The rollers 83 accordingly have rolling movement within the track channels 84 and 85 for guiding the chute in its reciprocating movement and which is effected by movement of the chain mechanism 76 and 77, an endless chain being located to each side of the chute as best shown in FIGURES 4 and 6. A connecting lug such as 88 is employed for connecting each chain mechanism to the chute. The lugs preferably join the upper reaches of the chain mechanisms to the chute so that when the lugs 88, FIGURE 1, are caused to move in a diagonal direction toward the left, the chute is extended, and, conversely, when the chain mechanisms reverse their movement to cause travel of the lugs 88 in a direction towards the right, the chute is retracted.

For supporting the end of the chute at the rear of the frame 20, the invention provides a roller 90 fixed to shaft 91 and which is journaled by the members 92. The journaling members are suitably supported in spaced relation on the bracket plates 37 which are in turn supported by the brackets 34 and 35. When the chute is projected by actuation of the chain mechanisms the rear extending end of the chute is supported by and the same rolls on the roller 90. Due to the inclination of the track channels it will be understood that as the chute is projected its extending end is progressively lowered and when fully extended the said end will be located adjacent and immediately above a ladle. Similarly, when retracted the chute is drawn within the lower frame and its extended end is elevated until a full retracted position is reached as shown in FIGURE 1.

A hand wheel 93 is provided for effecting reciprocating movements of the chute and said hand wheel is manually actuated by the operator. The supporting structure 94 suitably journals the shaft 95 to which the hand wheel is fixed, the same being mounted adjacent one side of the lower frame for convenient access by the operator. The shaft 95 also has fixed thereto a sprocket wheel 96 and which is in longitudinal alignment with sprocket wheel 97 located on the shaft 73. The sprocket wheels 96 and 97 are operatively connected by the endless chain mechanism 98, and accordingly rotation of the hand wheel 93 is transmitted to shaft 73 and through the sprocket wheels 74 and 75 to the chain mechanisms 76 and 77. When the hand wheel 93 is rotated in one direction, namely clockwise, FIGURE 1, the chute is retracted, and when the hand wheel is rotated counterclockwise the chute is projected.

Since the ladle addition feeder of the invention is mounted on an industrial truck, such as 12, it can be moved from place to place within the plant for performing its several operations. For filling the hopper with material for alloying with the molten metal, the unit is positioned under storage bins. The material will be granular and the same will pass down through the hopper and through opening 50 and will come to rest on the vibrating feeder pan 52. The material is restrained against lateral movement by the side walls of the feeder pan and the material is prevented from discharging rearwardly by means of the gate 63 which will be closed at this time. Before discharging the material, the operator will rotate the hand wheel 93 to project the chute 80 and by proper positioning of the truck 12, the projecting end of the chute can be located immediately above the ladle which is to receive the alloying materials during the pouring cycle. The gate 63 is lifted and the vibrating mechanism 53 is then placed in operation and the resulting vibration of the inclined feeder pan will discharge the material onto the rearwardly inclined chute 80. From the chute the material will flow by gravity to be discharged into the ladle. The inclined pan 52 actually forms the bottom of the hopper and the pan may be given any desired form of vibrating or reciprocating movement, such as will produce a discharge of the solid materials from the pan into the chute. The discharge can be regulated to a degree by regulating the rate of the vibrating movement effected by the mechanism 53. Since the said mechanism is preferably of the electrical type, a variation in its rate of feed can be obtained by voltage control of the electric current.

However should a power failure occur during a period wherein it is necessary to supply alloying materials to a ladle, the upper frame 20 can be elevated, as shown in FIGURE 5, in which position of the upper frame the feeder pan 52 will discharge into the chute 80 by gravity. For this purpose the upper frame is pivoted to the lower frame by the pivot pins 21 and the frame 20 is elevated for said emergency discharge by a crane or the like, the depending hook 100 of the crane having connection with the lifting lugs 101 fixed to the front plates 42 of the frame.

The extreme projected position of the chute is determined by the stop 102 fixed to the bottom wall 81. Said stop is effective to limit extended movement of the chute since it will engage with the roller 90. The said stop 102 also determines the retracted position of the chute, since it contacts with a similar stop member 103 extending transversely of and being connected to the track channels on the underside of the same. It may be desirable at times to snub the movement of the chute in a projected direction so as to cause engagement of the stop 102 with the roll 90 in a manner which does not excessively jar the parts. For this purpose the invention provides a snubber in the form of a pivoted bar 105, FIGURES 7 and 8. Each said bar at its right hand end is suitably pivoted at 106 to lugs 107 extending upwardly from the top wall 108 of its track channel either 84 or 85. The snubbing bars 105 are located within longitudinal slots 110 formed in the top wall 108 of the track channels and the end of each bar opposite its pivot is associated with a coil spring 111 which is retained within the supporting structure 112 provided therefor. The spring is confined between the upper stop 113 and the free end of the bar 105 so that the bar is yieldingly urged in a downward direction to within its respective track channel. However, its downward movement is limited by the stop pin 114. Upward movement of each bar 105 is permitted to the extent of the slots 115 formed in the supporting structure 112. The snubbing mechanism is incorporated in each track channel at the end of the channel adjacent the rear of the lower frame and thus the rollers 83 are free to roll within the track channels until the chute approaches its extreme position in a projected direction. At this point in the movement of the chute, the rollers 83 will engage the snubbing bars 105 and the rollers will be pinched between the bars and the lower wall 116 of the channels. The snubbing action can be regulated to a limited extent by regulating the compressive force exerted by the coil spring 111.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In apparatus for adding solid material in discrete form to molten metal contained in a ladle, the combination including frame structure supporting a hopper at its upper end, a feeder pan located below the hopper, means for vibrating the feeder pan to effect discharge of the material from the discharge end of the pan, a discharge chute having a material receiving end and a discharge end and adapted to be projected into an inclined material delivering position between the feeder pan and the ladle and to be retracted from said position to within the frame structure, means mounting the chute for reciprocating movements to and from said projected and retracted positions, said means including a support located on the frame structure below the discharge end of the feeder pan and positioned for supporting the discharge end of the chute when the chute is in retracted position, a pair of track channels supported by and located within the frame structure on respective sides of the chute, said track channels being diagonally disposed with respect to the horizontal and with the end of the track channels adjacent the fixed support having the highest elevation, means fixed to the chute at its receiving end and located within the track channels, respectively, for guiding the chute during the reciprocating movements thereof, and endless chain mechanism having connection with the chute at its receiving end for effecting said reciprocating movements.

2. Apparatus for adding solid material in discrete form to molten metal as defined by claim 1, wherein the support comprises a roller journalled by the frame structure for rotation and having contact with the underside of the chute to facilitate reciprocating movements of the chute.

3. Apparatus for adding solid material in discrete form to molten metal as defined by claim 1, wherein the support comprises a roller journalled by the frame structure for rotation and having contact with the underside of the chute to facilitate reciprocating movements of the chute, and wherein the end of the track channels having the highest elevation are located below the discharge end of the feeder pan but above the roller support.

4. Apparatus for adding solid material in discrete form to molten metal as defined by claim 1, wherein the support comprises a roller journalled for rotation by the frame structure and having contact with the underside of the chute to facilitate reciprocating movements of the chute, and wherein the means fixed to the chute and located within the track channels also comprise rollers and which have rolling contact with the track channels during the reciprocating movements of the chute.

5. In a mobile ladle addition feeder, the combination with the platform of a vehicle, of a frame supported by said platform, a hopper supported by the frame at the upper end of the frame, a feeder pan located below the hopper, means for vibrating the feeder pan to effect discharge of the material from the discharge end of the pan, a discharge chute having a material receiving end and a discharge end and adapted to be projected from the frame into an inclined material delivering position below the feeder pan, and to be retracted from said position to within the frame, means mounting the chute for reciprocating movements to and from said projected and retracted positions, said means including a roller journalled by the frame and located below the discharge end of the feeder pan, a pair of track channels supported by and within the frame and disposed on respective sides of the chute, said track channels extending at an angle to the horizontal with the end of the track channels having the highest elevation being located above the roller but below the discharge end of the feeder pan, means fixed to the chute at its receiving end and located within the track channels, respectively, for guiding the chute during the reciprocating movements thereof, mechanism having connection with the chute at its receiving end for effecting said reciprocating movements, snubbing means for the discharge chute for frictionally braking its movement in a projecting direction, said snubbing means having associated relation with the track channels adjacent that end of the channels of highest elevation, and said snubbing means including a spring energized bar adapted to coact with the said means fixed to the chute and which are located within the said track channels.

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