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J. McRAE & G. H. KITTO.

APPARATUS FOR WITHDRAWING MOLTEN METAL FROM FURNACES, &c., AND CHARGING SAID METAL INTO MOLDS, &c.

(Application filed Aug. 10, 1899. Renewed Oct. 31, 1900.)

(No Model.)

Fig. 2.

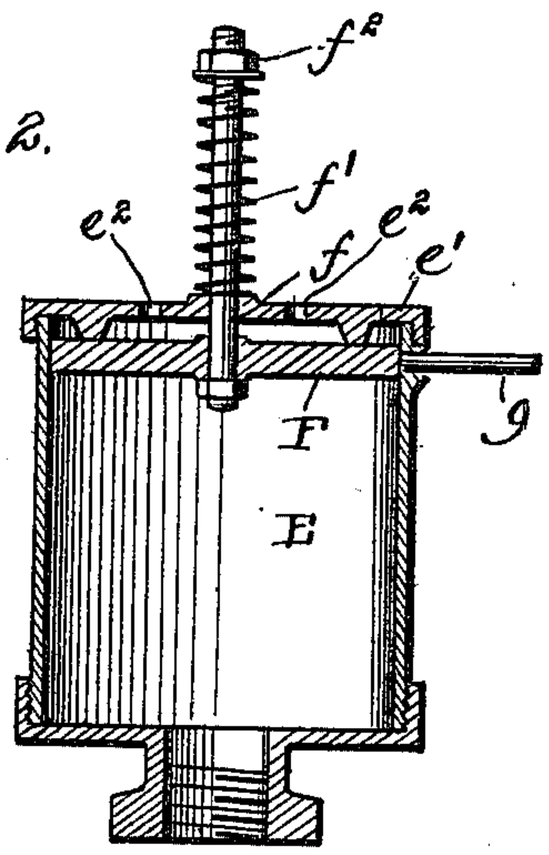
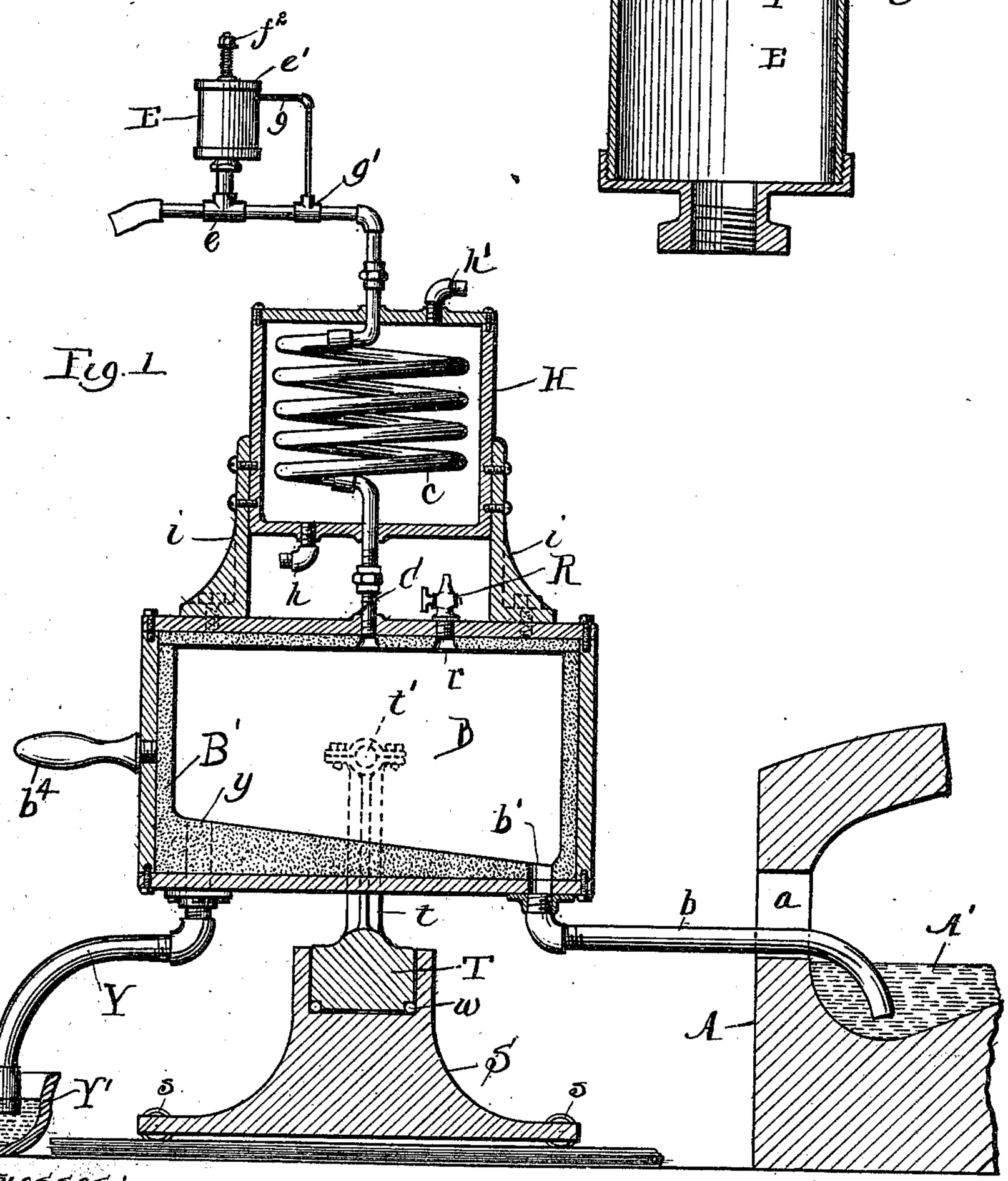


Fig. 1.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR WITHDRAWING MOLTEN METAL FROM FURNACES, &c., AND CHARGING SAID METAL INTO MOLDS, &c.

SPECIFICATION forming part of Letters Patent No. 669,466, dated March 5, 1901.

Application filed August 10, 1899. Renewed October 31, 1900. Serial No. 35,047. (No model.)

To all whom it may concern.

Be it known that we, JAMES McRAE and GEORGE H. KITTO, citizens of the United States, and residents of Dollar Bay, in the county of Houghton, State of Michigan, have invented certain new and useful Improvements in Apparatus for Withdrawing Molten Metal from Furnaces or the Like and Charging said Metal into Molds or Suitable Receptacles, of which we declare the following to be a full, clear, and exact description.

Our invention has for its object more especially to provide an improved apparatus whereby the metal within a melting-furnace or crucible may be withdrawn therefrom and may be delivered into suitable molds or the like; and the invention consists in various features of improvement hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a view in central vertical section through an apparatus embodying our invention, parts being shown in elevation. Fig. 2 is an enlarged detail view of the means for regulating the extent of vacuum that may be exerted in withdrawing the metal from the furnace.

A designates the bed or hearth of a melting-furnace, A′ indicating the molten metal therein. Through the door or opening *a* of the furnace extends a nozzle or pipe *b*, that is connected to the port *b′* of the vessel B, into which the metal A′ will be drawn from the furnace A. The vessel B may be of any suitable or convenient shape, and preferably this vessel comprises a metal body suitably lined with fire-brick B′ or like refractory material. From the vessel B leads an exhaust-pipe C, the opposite end of this pipe being suitably connected—as, for example, by a hose or like flexible pipe—with an exhaust-pump, the purpose of this pipe C being to exhaust the air from the chamber B, thereby producing within the chamber a sufficient vacuum to cause the molten metal A′ to pass from the furnace A through pipe *b* and port *b′* into the vessel B. We are aware that it has been heretofore proposed to withdraw the molten metal from a furnace by producing more or less of a vacuum within the molds or ingots into which the metal is to be charged, and we do not wish, therefore, to be understood as claiming, broadly, such method. It is of importance in withdrawing molten metal from a furnace that the extent of the vacuum shall be properly regulated, and it is important, also, that the air withdrawn from the vessel shall be cooled before it passes through the suction-hose and into the exhaust-pump. One important feature of the present invention is the provision of means for automatically regulating the extent of vacuum within the vessel into which the metal is withdrawn from the furnace, and another important feature of the invention is the provision of suitable means for cooling the air before it is delivered through the suction-hose into the exhaust-pump.

A further feature of the present invention is the provision of a vessel adapted to receive a charge of molten metal from a furnace or the like, the vessel being provided with a suction-pipe, whereby the air will be exhausted therefrom, and being provided with a relief-valve, whereby the flow of metal from the vessel can be controlled, said relief-valve being arranged independently of the exhaust mechanism, so that the extent of vacuum within the vessel may be modified by the manipulation of the relief-valve while the action of the exhaust mechanism continues.

In order to automatically regulate the extent of vacuum within the vessel B, a regulating-valve mechanism is interposed in the pipe C at some convenient point between the vessel B and the suction-pump. Preferably the regulating-valve mechanism comprises a cylinder E, that is suitably connected to a T-coupling *e*, interposed in the suction-pipe C. Within the cylinder E is placed a piston F, the stem *f* of which leads to the top or cover *e′* of the cylinder and is encircled by a coiled spring *f′*, that bears against the cover at its lower end, while its upper end is held by an adjusting-nut f^2, carried by the upper threaded end of the stem or rod *f*. The cover *e′* is provided with one or more holes e^2 to permit the pressure of atmospheric air upon the upper part of the piston F. In the upper part of the cylinder E is formed a port with which connects a relief-pipe *g*, that is coupled, as at

g', to the suction-pipe C. It will thus be seen that by adjusting the nut f^2 the force exerted by the spring f' in holding the piston F to the normal position (seen in Fig. 2) can be accurately regulated, and this adjustment of the nut f^2 will depend upon the amount of vacuum required in drawing the metal into the vessel B. If now it be assumed that a suitable suction-pump is connected with the free end of the suction-pipe C (or with the hose leading therefrom) and this pump is set in operation, air will be withdrawn from the vessel B, producing more or less of a vacuum therein and causing the metal to flow from the furnace A into the vessel B. When the metal has risen to the desired height in the vessel B, (depending upon the extent of vacuum,) any excess exhaustion due to the operation of the suction-pump will cause the piston F to descend until it uncovers the inner end of the relief-pipe G, thereby permitting atmospheric air to pass into the suction-pipe, and thus diminish the vacuum. The attention of the operator is therefore not required to note the height of the metal within the vessel B, since the operation of the regulating-valve mechanism will prevent the lifting of the metal beyond the desired predetermined height.

In order to cool the air that is withdrawn from the vessel B, we interpose at some suitable point between the vessel B and the suction-pump a water-chamber H, through which the suction-pipe C is extended, preferably in a spiral coil c. As shown, the water-chamber H is attached by suitable brackets i to the side of the vessel B; but manifestly this location of the water-chamber is not essential. Water will be delivered by an inlet-pipe h to the vessel H and will be discharged therefrom by the outlet-pipe h', it being understood that suitable leads of hose or piping will be connected with the inlet and outlet pipes h h'.

In order to permit the vessel B after it has received the charge of metal from the furnace A to deliver the molten metal into suitable molds or the like, a relief-valve R is connected with a port r in the upper part of the vessel B or at any other suitable point, whereby the air may be admitted to reduce the vacuum in chamber B. When, therefore, the vessel B has received its charge, the pipe or conduit b will be withdrawr from the furnace A and its discharge end will be brought over the mold or like receptacle to be filled. The operator will then turn the handle of the relief-valve R (which is normally closed) so as to admit air and reduce the vacuum within the vessel B, and so permit the metal to flow therefrom. This valve may be manipulated in such manner as to produce a flow as slight or as strong as may be desired or stop flow entirely at any stage of the operation and resume again at will of operator. In order to allow for the convenient discharge of the metal in the vessel B, we prefer to mount this vessel upon a traveling base or carriage S, that is sustained by wheels s, traveling upon suitable tracks, and in order that the vessel B may be conveniently turned it is preferred to sustain this vessel by suitable yoke t, the ends of which engage the trunnions t' at the sides of the vessel, the base T of the yoke resting upon ball-bearings w on the top of the carriage S, or the apparatus may be suspended from above in such manner as to be moved wherever desired on trolley-wheels bearing on an overhead track. At one end of the vessel B is attached a suitable handle b^4 to enable the vessel to be readily manipulated after it has been filled; but if desired any suitable means, such as a circular rack and pinion, may be used for tilting the vessel. Before proceeding to fill the chamber with molten metal it may be necessary to heat same to prevent the metal from cooling too rapidly. This may be accomplished by projecting pipe b into furnace A, leaving mouth or open end of pipe b immediately over molten metal, then proceeding to operate pump, when the hot air will pass into system and heat the chamber B.

From the foregoing description it will be seen that when molten metal is to be withdrawn from the furnace A the curved end of the pipe or conduit b will be inserted into the bath A' of metal, after which the pump will be started, thereby exhausting the air from the vessel B and causing the metal A' to flow from the furnace to the vessel, it being understood, of course, that at such time the relief-valve R will be closed. When the vessel B has received its charge, the pipe b will be withdrawn from the furnace and the vessel B will be tilted and turned or moved so as to bring the pipe b into proper position for discharging the contents of the vessel into suitable molds or like receptacles. The operator by opening the relief-valve R more or less can so reduce the vacuum within the vessel B as to cause the metal to flow therefrom into the molds or receptacles to be filled.

When it is desired to draw metal from one vessel or crucible into another at a lower level than the first or into molds or vessels which may be set at a lower level, we may employ the discharge-pipe Y, that is attached over the port y in the wall of the chamber B, the lower end of the pipe Y terminating, as shown, at a point lower than the open end of the pipe b. When the pipe Y is to be used as a discharge-pipe for the purpose above stated, the end of the pipe b will be inserted into the bath of metal in the furnace from which the charge is to be withdrawn, and the lower open end of the pipe Y will be submerged in a ladle Y' of molten metal placed at such point. The air will then be withdrawn from the chamber B in manner above described, thereby causing the metal to rise through the pipe b into the chamber B and at the same time causing the metal to rise through the pipe Y from the ladle that will be placed beneath it. As soon, however, as the metal from the furnace A reaches such a

height in the chamber B that it will flow into the pipe Y a constant flow will be established through the pipe Y and into any molds or vessels located below the end of such pipe. This flow through the pipe Y may be regulated or stopped and resumed, as hereinbefore described. If desired, the pipe Y may have its lower end provided with a branch pipe y', to which may be connected a hose or pipe, whereby air may be forced into the molten metal as it reaches the lower end of the pipe Y for the purpose of "rabbling" the metal, this being of advantage, particularly in the case of refining copper.

It is manifest that the precise details of construction above set out may be varied without departing from the spirit of the invention.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. An apparatus of the character described comprising a movably-supported vessel adapted to receive a charge of molten metal from a furnace and provided with a suitable pipe or conduit for the passage of metal, said vessel being also provided with a suction-pipe independent of the metal conduit-pipe whereby air may be exhausted therefrom, and with a relief-valve for air having an adjustable opening and located above the space to be occupied by the metal, whereby the flow of metal from the vessel can be controlled in order to permit the partial or complete discharge of its contents.

2. In apparatus of the character described, the combination with a suitable vessel and with a pipe or conduit for admitting metal thereto from a furnace or the like, of a suction-pipe connected with said vessel and an automatic regulating-valve mechanism for air located above the space to be occupied by the metal whereby the extent of vacuum may be automatically controlled.

3. In apparatus of the character described the combination of a vessel adapted to receive a charge of molten metal from a furnace and provided with a suitable pipe or conduit for the passage of metal, an independent suction-pipe whereby air may be exhausted from said vessel, and a relief-valve having an adjustable opening for air located above the space to be occupied by the metal, whereby the flow of metal from said vessel can be controlled, said relief-valve being arranged independently of the exhaust mechanism in order that the extent of vacuum within the vessel may be modified while the action of said exhaust mechanism persists.

4. An apparatus of the character described, comprising a suitable vessel provided with a pipe or conduit for the admission of metal to said vessel and provided also with a suction-pipe for exhausting the air from said vessel and with a relief-valve for controlling the flow of metal from the vessel and provided also with a discharge-pipe having its lower end extending to a point below the end of the pipe or conduit whereby molten metal is admitted to the vessel, said discharge-pipe being provided with an air-admission pipe whereby air may be blown into the metal being discharged through said pipe.

5. In apparatus of the character described, the combination with a suitable vessel and with a pipe or conduit for admitting metal thereto from a furnace or the like, of a suction-pipe connected with said vessel, and an automatic regulating-valve mechanism whereby the extent of vacuum may be automatically controlled, said regulating-valve mechanism comprising a cylinder, a spring-actuated piston within said cylinder and a relief-pipe leading from said cylinder to the suction-pipe.

6. In apparatus of the character described, the combination with a suitable vessel and with a pipe or conduit for admitting metal thereto from a furnace or the like, of a suction-pipe connected with said vessel, and an automatic regulating-valve mechanism whereby the extent of vacuum may be automatically controlled, said regulating-valve mechanism comprising a cylinder, a spring-actuated piston within said cylinder, an adjusting-screw for regulating the force of the spring upon the piston, and a relief-pipe leading from said cylinder to the suction-pipe.

7. In apparatus of the character described, the combination of a vessel adapted to receive a charge of molten metal from a furnace and provided with a suitable pipe or conduit for the passage of metal, an independent suction-pipe whereby air may be exhausted from said vessel, a relief-valve for air having an adjustable opening and located above the space to be occupied by the metal, whereby the flow of metal from said vessel can be controlled, and a suitable carriage whereon said vessel is mounted in manner free to be tilted in vertical direction.

8. In apparatus of the character described, the combination of a vessel adapted to receive a charge of molten metal from a furnace and provided with a suitable pipe or conduit for the passage of metal, an independent suction-pipe whereby air may be exhausted from said vessel, a relief-valve for air having an adjustable opening and located above the space to be occupied by the metal, whereby the flow of metal from said vessel can be controlled, and a suitable support whereby said vessel is sustained in manner permitting it to be turned in horizontal direction.

9. In apparatus of the character described, the combination of a vessel adapted to receive a charge of molten metal from a furnace and provided with a suitable pipe or conduit for the passage of metal, an independent suction-pipe whereby air may be exhausted from said vessel and a relief-valve having an adjustable opening for air, said relief-valve being arranged independently of the exhaust mechanism in order that the extent of vacuum

within the vessel may be modified while the action of said mechanism persists.

10. In apparatus of the character described, the combination with a suitable vessel and with a pipe or conduit for admitting metal thereto from a furnace or the like, of a suction-pipe connected with said vessel and a suitable carriage whereon said vessel is mounted in manner free to be tilted in vertical direction and turned in horizontal direction.

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