United States Patent

[11] **3,530,915**

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[33] **Japan**
[31] **42/69,238**

[54] **SLICER**
3 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **146/105,** 83/92, 83/490, 83/647.5, 146/94, 146/125
[51] **Int. Cl.** **B23d 19/00,** B26d 1/28
[50] **Field of Search** 146/105, 125, 101; 83/411, 646, 647.5; 146/94; 83/167, 475, 490, 92

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ABSTRACT: A slicer having a rotary blade adapted to automatically slice a material held in an immovable state in a predetermined thickness while making both rotational and pivotal movements at a fixed position, a mechanism to adjust the thickness of sliced pieces as desired and a mechanism to slice the material in a uniform thickness under uniform pressure.

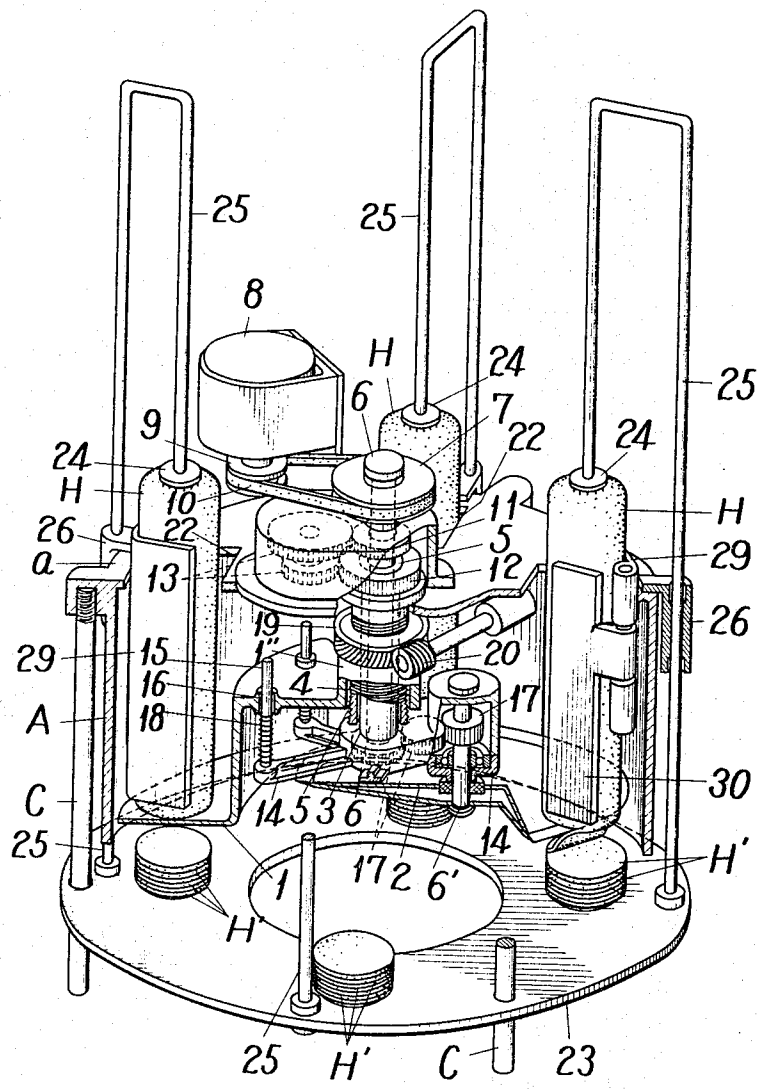

Fig. 1

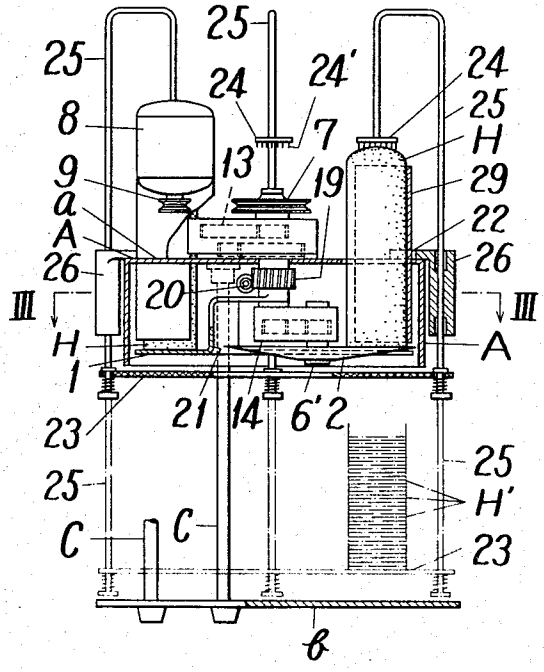

Fig. 3

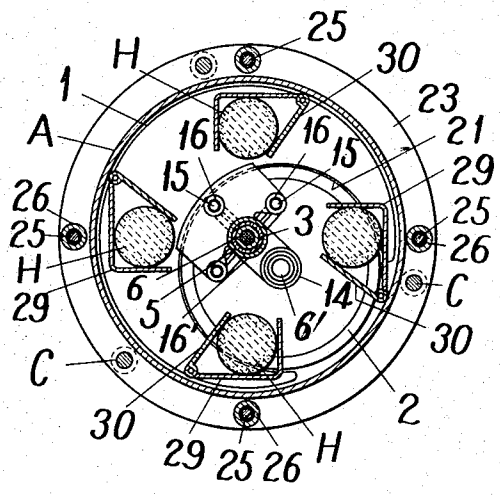

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Fig. 4

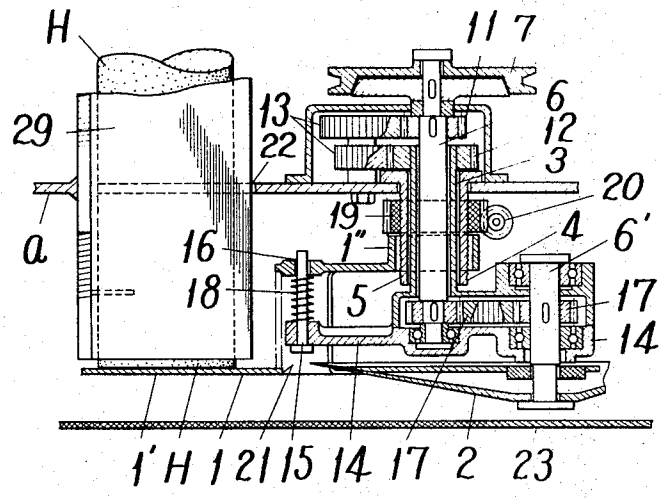

Fig. 5

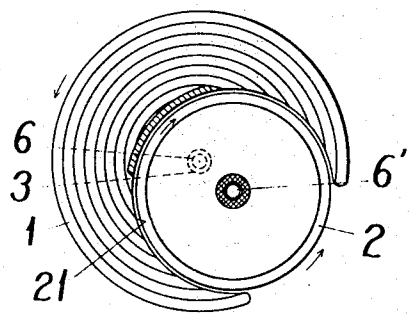

Fig. 2

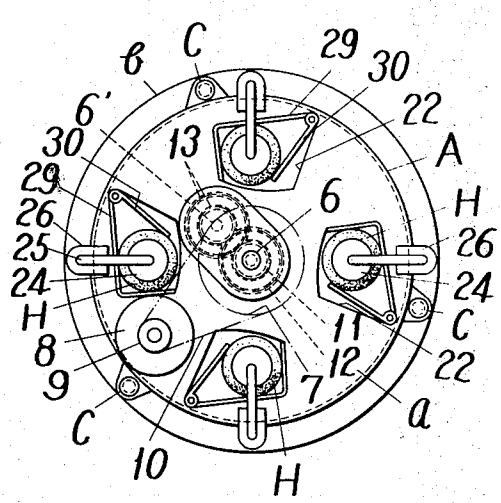

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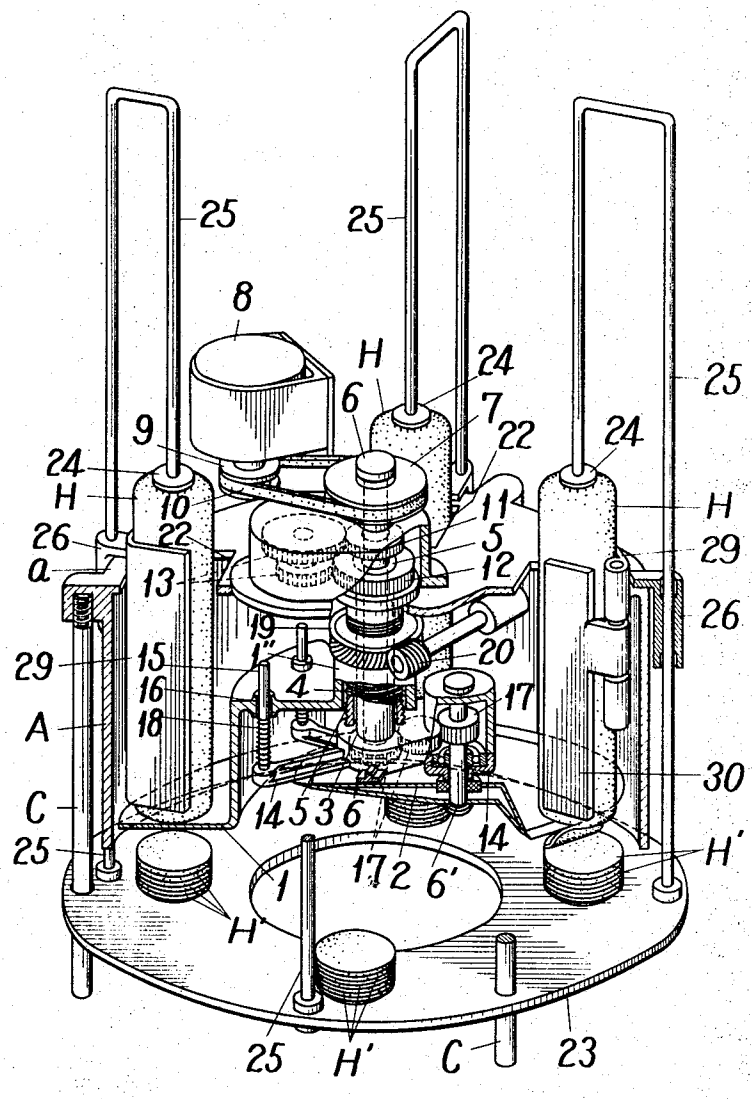
Fig. 6



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SLICER

This invention relates to an improvement of a slicer having a rotary blade member adapted to pivot on a main rotary shaft while executing its own rotation at a high speed and in so doing, cuts a material held in a substantially immovable state within the area defined by its pivotal movement into slices of uniform thickness progressively from the bottom upwardly.

The principal object of the present invention is to provide an improved means for such a slicer whereby the rotary blade is permitted to execute both pivotal and rotational movements at a fixed position at all times, thus making it unnecessary to move the blade in the axial direction of the main shaft with the progress of the slicing operation.

A further object is to provide a means for such a slicer whereby a material can be sliced accurately and efficiently in a uniform thickness one by one under a constant pressure, while it is placed simply on a supporting plate without being raised and lowered or fed mechanically.

Another object is to provide a means so that sliced pieces are allowed to fall down simultaneously with the cutting and accumulate on a slice-receiving disk provided therebelow in an orderly manner to facilitate subsequent packing or weighing.

Still another object of the present invention is to provide a means for adjusting the thickness of slices freely.

The nature and further advantages of the present invention will be more clearly understood by the following description in connection with the accompanying drawings, in which:

FIG. 1 is a view partly in side elevation and partly in vertical section of a slicer in accordance with the present invention,

FIG. 2 is a plan view of same,

FIG. 3 is a view taken along line III–III of FIG. 1 the view looking in the direction of the arrows,

FIG. 4 is a view partly in front elevation and partly in vertical section of a driving mechanism of the slicer,

FIG. 5 is a plan view showing an operational relationship between a rotary blade member and a slice-receiving plate, and

FIG. 6 is a perspective view partly in section of the various components of the slicer.

Referring to the drawings showing one embodiment of the invention, a frame A comprises a top plate *a* and a bottom support plate *b* rigidly connected together by means of a rod *c* provided at several places on the support plate *b*. Rotatably mounted in the central part of the top plate *a* is an outer cylindrical shaft 5 having a threaded outer surface, shaft 5 accommodates an inner cylindrical shaft 3 rotatably mounted therein. The inner cylindrical shaft 3 in turn accommodates a main rotary shaft 6 therein. The main shaft 6 is caused to rotate at a high speed by a link belt 10 operably connecting a pulley secured to the upper end of the shaft 6 to a pulley 9 of a motor 8 mounted on the frame A.

A pinion 11 and a gear wheel 12 are secured to the main shaft 6 and the inner cylindrical shaft 3 respectively, and the two gear members are operably connected to each other by an intermediate gear wheel 13, so that when the main shaft 6 starts a high-speed rotation, the inner cylindrical shaft 3 rotates at a low speed by means of the transmission gear members 11, 12 and 13.

Provided at the lower end of the inner cylindrical shaft 3 is an arm 14 which carries at one end a rotatable shaft 6′ driven at a high speed by the main shaft 6 through a transmission gear wheel 17. The rotatable shaft 6′ has a rotary blade member 2 rigidly secured to its lower end. It will thus be understood that the shaft 6′ of the rotary blade 2 is eccentric to the main shaft 6 and when the main shaft rotates, the shaft 6′ is caused to pivot on the main shaft 6, revolving around the latter while rotating itself.

Referring next to a mechanism for supporting a material to be sliced, the lower part of the outer cylindrical shaft 5 is accommodated in a central tubular part 1″ of a circular supporting plate 1 supported in position by one end of the arm 14 at the lower end of the inner cylindrical shaft 3. The supporting plate 1 is provided with a flat peripheral surface 1′ on which a material is placed.

As to the method of supporting the material, the supporting plate 1 and the arm member 14 are connected together by a pintle 15 inserted through a hole 16 provided in the upper flat surface of the supporting plate 1 and one end of the arm 14 located opposite to the end on which the axis 6 of the rotary blade is provided. By means of a coil spring 18 mounted on the pintle 15, the supporting plate 1 is held firmly in position and constantly pressed upwardly by the elasticity of the spring.

The circular supporting plate 1 consists of a disk having therein a circular cutout 21 eccentric to the axis of the disk. The operational relationship between the cutout 21 and the rotary blade 2 will be later described.

Engaging the outer cylindrical shaft 5 is a worm wheel 19 which operates to stop upward movement of the supporting plate 1 as the upper end of the central tubular part 1″ of the plate 1 abuts against the undersurface of the worm wheel 19.

Provided in the top plate *a* of the frame A along its periphery are one or more holes 22 through which material H is inserted so that its bottom part will rest on the lower flat surface 1′ of the periphery of the supporting plate 1.

However, if the material H alone is placed on the supporting plate 1, it tends to sway when the rotary blade 2 contacts and strikes its lower portion for slicing, thereby making it difficult to perform accurate cutting work. In order to prevent the swaying of the material H, a bracket 26 is provided on the frame A and carries a connecting rod 25 mounted slidably therein. The connecting rod 25 is provided at its free downward end with toothed presser plate 24 fixed thereto in such a manner that needles 24′ carried on the underside of the plate 24 thrust into the top portion of the material H to hold the latter in place. In addition, a pair of adjustable holder plates 29, 30 are secured at their back portions to the frame A to hold the material therebetween to prevent the material from moving sideways. However, the adjustable holder means should not have so strong a holding power as to make it impossible for the material to slide down under its own weight as it is sliced from the bottom upwardly.

Under this structure, it is natural that the supporting plate 1 should sustain the total weight of the material H, the presser plate 24 and the connecting rod 25, and the plate 1 is, by the pivotal movement of the arm member 14 on its pivot shaft 3, caused to rotate, abrading the bottom portion of the material H which is, as previously explained, immovably supported on the lower flat peripheral surface 1′ of the supporting plate 1 by the connecting rod 25, the presser plate 24 and the holder means 29, 30. At this time, the upper surface of the central tubular portion 1″ maintains contact with and abrades the underside of the worm wheel 19 which is in an immovable state.

As already described, both the supporting plate 1 and the rotary blade 2 are mounted on the arm member 14 which constitutes the common supporting means therefor. Accordingly, when the former having a large diameter is rotated on the inner cylindrical shaft 3 or the main shaft 6 as its axis, upon rotation of the arm member 14, the latter having a small diameter and being eccentrically disposed, likewise pivots on the shaft 3 or 6 while rotating itself. Referring to the relation between 1 and 2, the latter is always, as illustrated in FIG. 5, precisely overlapping the circular cutout 21 when viewed from above, but as shown in FIGS. 1 and 4, the flat peripheral portion 1′ of the former is disposed a step lower than the level of the area defined by the edge of the latter, with the result that there exists a height wise gap between the two members 1 and 2. This gap per se represents the thickness of the sliced pieces of the material H obtained with the rotary blade 2. Accordingly, the greater the height of the gap between the rotary blade 2 and the flat portion 1′ becomes by lowering the position of the latter, the larger the thickness of the sliced pieces of the material. On the other hand, the smaller the height of the gap becomes by moving up the flat portion 1′ of the supporting plate, the smaller the thickness of the sliced pieces of the material. As to a mechanism for an up and down adjustment of this gap, a description thereof will follow hereinafter.

Now, the supporting plate 1 and the rotary blade 2 are rotated on the shaft 3 with the latter always lying over the former at a position eccentric to the former. Since the material H is held in an immovable state, being inserted in the hole 22 of the top plate *a* , the upper surface 1' of the supporting plate 1, which carries and receives the bottom of the material H, will naturally rotate, thereby always abrading the bottom surface of the stationary material. At the time of the slicing operation which is performed as the rotary blade 2 comes to contact and strike against the bottom part of said material H in the course of its pivotal movement, the bottom portion of the material always overlies an opening formed by the cutout 21 so that the sliced end of the material is momentarily supported by the rotary blade 2 only, and then the sliced piece drops downwardly through the cutout 21. As the rotary blade 2 changes its position with the progress of its revolution or pivotal movement, the material H moves downwardly by an amount corresponding to the height of the gap, and is again supported by the flat portion 1' of the supporting plate. In this manner, the slicing is effected once in one cycle of the pivotal movement of the rotary blade 2.

Referring to a mechanism for adjusting the height of the gap between the supporting plate 1 and the edge of the rotary blade 2 so as to adjust the thickness of slices freely, there is the worm wheel 19 geared to the outer cylindrical shaft 5, which operates itself as a stop against the further upward movement of the supporting plate 1 at the time of machine operation, as already described. The worm wheel 19 is engaged by a worm 20 with its worm lever extended externally of the frame, so that, by operating the worm lever outside of the frame, the worm wheel 19 is caused to move upwardly or downwardly. Thus, when the worm wheel moves upwardly, the supporting plate 1 which is pressed upward by the spring 18 also goes upwardly, reducing the height of the gap between the flat portion 1' and the rotary blade 2, with the result that the thickness of the sliced piece is reduced. On the other hand, if the worm wheel 19 is lowered, the difference is enlarged, thus resulting in thicker sliced pieces. Once the position has been determined for a particular thickness, the worm wheel 19 remains in that position unless it is turned by its external lever, so that the thickness of the sliced pieces remains uniform from the start to the finish of the slicing operation, without giving rise to any irregularity.

A receiving disk 23 adapted to receive the sliced pieces is fixed to the downward base end of the connecting rod 25. As already described, since this connecting rod 25 is only loosely accommodated in the bracket 26 on the periphery of the frame A, it slides freely upwardly and downwardly therein and when there is no material to be cut H, the under-surface of the presser plate 24 descends under its own weight to a position in which its further downward movement is stopped by the flat portion 1' of the supporting plate 1. Accordingly, the slice-receiving disk 23 is moved upwardly and downwardly in cooperation with the movement of the connecting rod 25.

As a natural consequence of the above-described relationship between the connecting rod 25 and the slice-receiving disk 23, the supporting plate 1 will sustain the total weight of the connecting rod 25, the presser plate 24, and the material H, added by the weights of the receiving disk 23 and the sliced pieces H' which have fallen upon the receiving disk.

Referring to the method of use, the material to be cut H is at first inserted downwardly through the opening of the top plate *a* of the frame A with its bottom placed on the flat peripheral portion 1' of the supporting plate 1 and with both sides embraced lightly by the holder plates 29, 30. The connecting rod 25 is brought downwardly from above to press the material to be cut H with the presser plate 24 provided at the downward tip of the connecting rod 25.

On the other hand, the lever of the worm 20 is operated to determine the position of the worm wheel 19, whereby the height of the gap between the flat portion 1' of the supporting plate and the edge position of rotary blade 2 is determined, and as a result the thickness of the piece of material to be sliced.

Under the above arrangements, the electric motor 8 is activated, whereupon the main rotary shaft 6 is rotated at a high speed, thereby the rotary blade 2 to rotate on its own axis at a high speed and simultaneously the inner cylindrical shaft 3 to rotate at a low speed. Then, upon the slow-speed rotation of the inner cylindrical shaft 3, the rotary blade 2 pivots or revolves on the axis of the main shaft 6, with a simultaneous rotation of the supporting plate 1. This supporting plate is rotated, thus maintaining the same eccentric relationship and same heightwise gap with the rotary blade 2 and abrades the bottom surface of the material to be cut. Thus, at the time when the rotary blade 2, pivoting on the main shaft while rotating on its own axis, comes into contact with and passes through the bottom of the material H which is held immovably there, a slicing of the relative portion of the material H is effected. However, since, as already stated, the position directly underneath the rotary blade 2 is always open (the circular cutout 21 of the supporting plate 1), a sliced piece H' falls through this opening as soon as it is sliced, and is received by the receiving disk 23. No sooner than the rotary blade 2 passes through the lower end of the material to be cut, the material descends under its own weight to move onto the flat portion 1' of the supporting plate which is positioned one step below the rotary blade, and its lower end is sliced as the rotary blade comes into contact therewith in a subsequent cycle. In this way, the material H is sliced from the bottom one by one upon each complete pivotal movement of the rotary blade 2 and the sliced pieces H' are accumulated on the receiving disk 23 one upon another in an orderly manner. As already explained, since the construction is such that the supporting plate 1 is to sustain the total weight of the material H, the presser plate 24, the connecting rod 25 and the receiving disk 23 during the slicing operation, even when the material is sliced off gradually, with the sliced pieces falling down one by one on the receiving disk 23, there is no change in the total weight working on the supporting plate 1. The only change will be, that with the completion of each slicing work, the receiving disk 23 drops downwardly by the distance corresponding to the volume of the downward movement of the material, thereby enlarging the distance between the receiving disk 23 and the supporting plate 1. However, since the sliced piece H' accumulates on the receiving disk 23, the position of the upper surface of the receiving disk will actually become higher by the thickness of the slice H' with the result that the distance between the supporting plate 1 and the upper surface of the accumulated slices remains always same throughout the slicing operation. By this unique mechanism, the falling distance of the sliced pieces remains constant despite the fact that the receiving disk 23 keeps moving downwardly continuously.

This provides a convenient packing and weighing of the sliced material on account of their automatic and orderly accumulation on the receiving disk 23 and, in addition, makes it possible to obtain a uniform slice under uniform pressure since the pressure working on the bottom of the material H is always constant.

According to the present slicer, the operation of slicing a given length of the material one by one from one end thereof by means of both rotational and pivotal blade action does not require the shifting of operational position of the rotary blade with the progress of the cutting operation nor make it necessary to effect the progressive feeding of the material into the rotary blade by any special mechanical means, thus ensuring a simpler construction and easier handling of the slicer.

Furthermore, this invention offers the advantages of freely adjusting the thickness of sliced pieces, producing slices of uniform thickness and permitting automatic and orderly accumulation of sliced pieces in order to facilitate packing and weighing or any other later processings and lastly being conveniently designed for use for cutting either one loaf or two or more loaves of material at the same time, if desired.

I claim:

1. A slicer of the type described, comprising a rotary blade member mounted on a machine frame and adapted to pivot on

a main rotary shaft while making its own rotation at a high speed and a substantially circular plate member for supporting a material to be sliced, said plate member having its central portion rigidly secured to said main shaft for rotation on said shaft in concert with the pivotal movement of said rotary blade, said plate member being provided with a flat portion around its periphery at a position substantially lower than the edge level of said rotary blade and a circular cut-out at a position directly underneath said rotary blade, a connecting rod movably mounted in the peripheral portion of the machine frame and adapted to slide downwardly under its own weight, a presser plate fixed to the free downward end of said connecting rod for pressing the tip portion of the material to be sliced from above and a disc member directly underneath the rotary blade and the support member for receiving sliced material and having its peripheral portion secured to the downward base end of the connecting rod.

2. The slicer as defined in claim 1, including a mechanism for adjusting a gap in height between the flat peripheral portion of said support member and the edge level of said rotary blade.

3. The slicer as defined in claim 1, including a vertical-type holding means secured at its back side to the machine frame and adapted to lightly embrace the material from both sides.