

May 16, 1933.

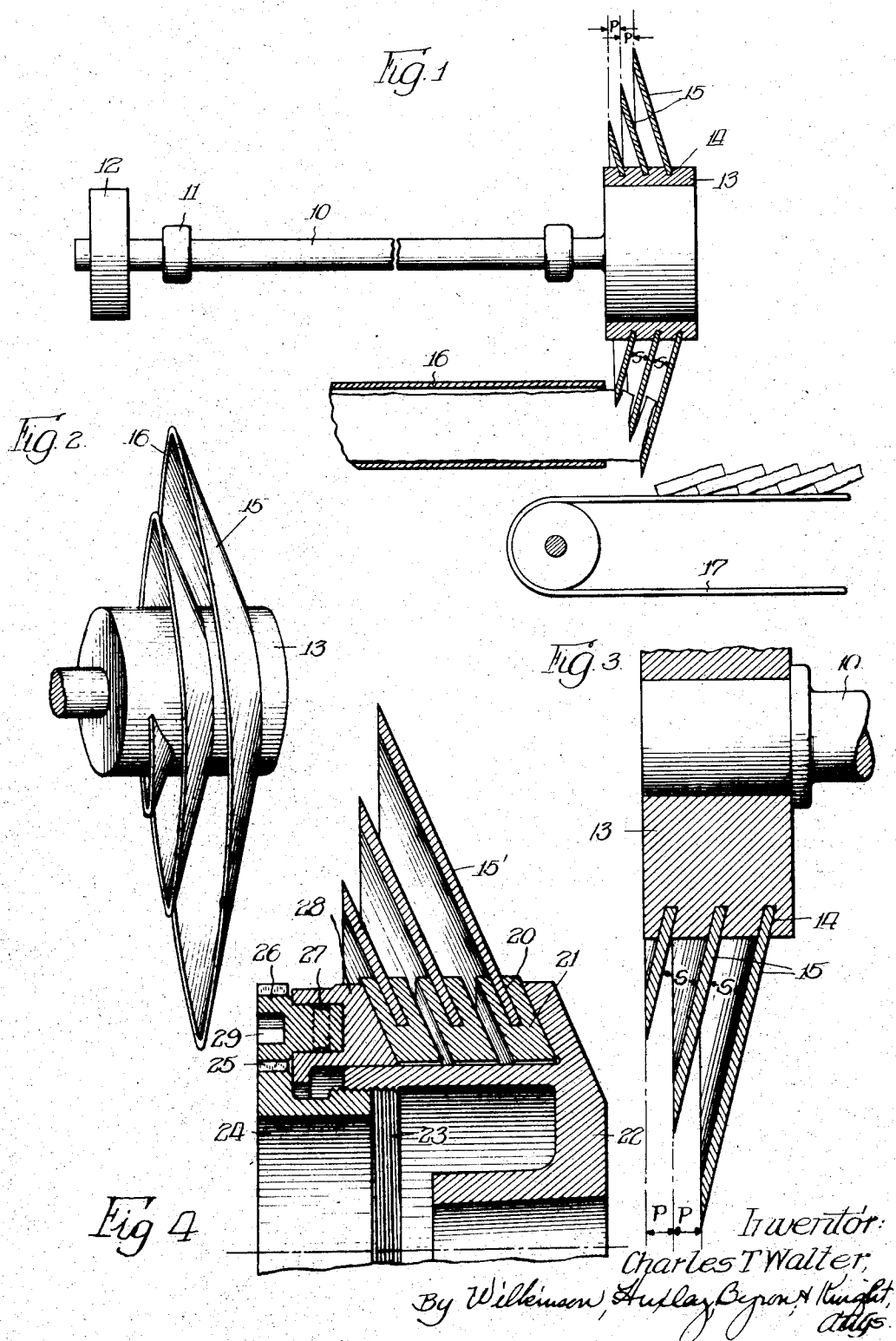
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SLICING MACHINE

Filed Aug. 13, 1930

2 Sheets-Sheet 1



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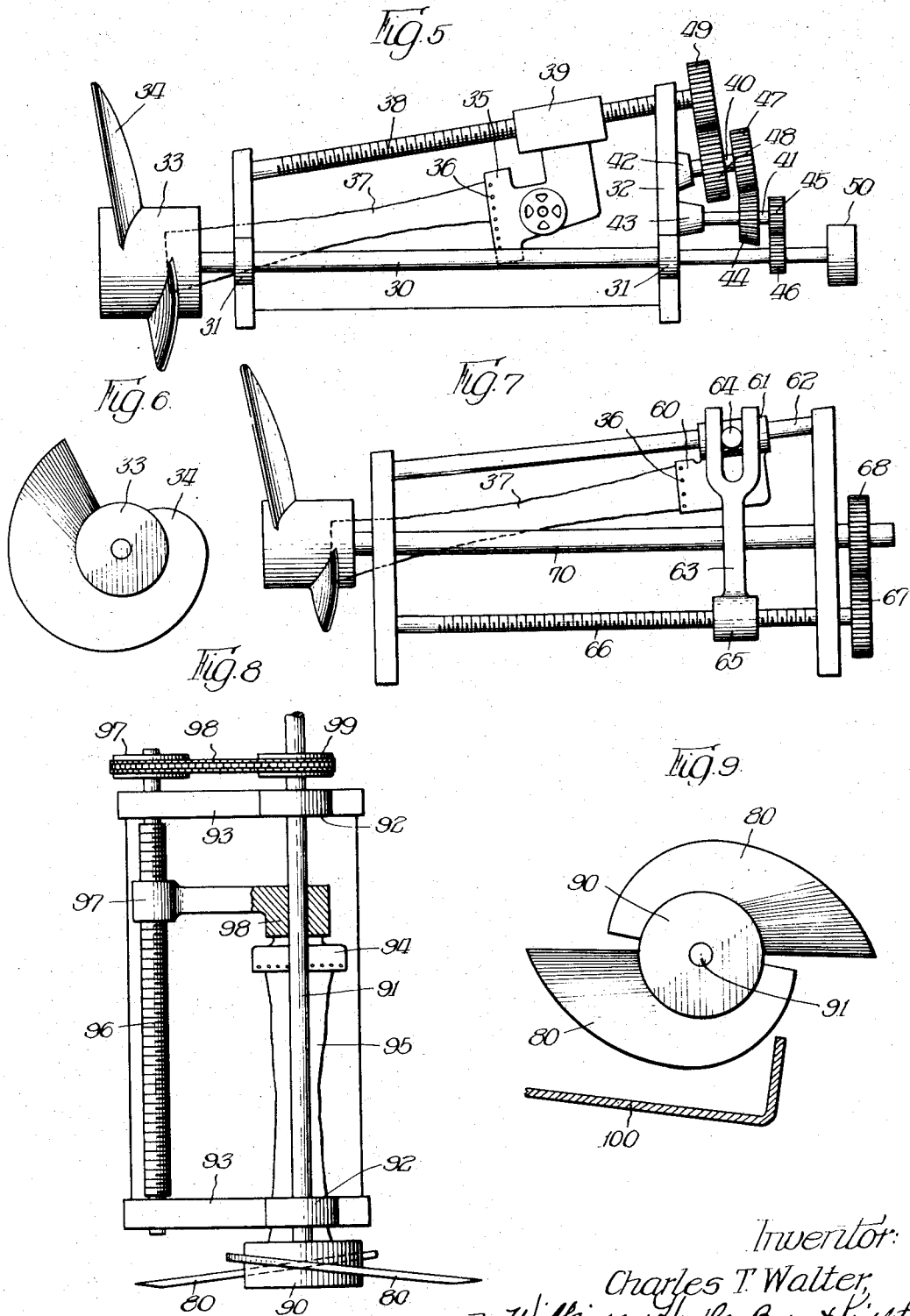
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UNITED STATES PATENT OFFICE

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SLICING MACHINE

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This invention relates to slicing or cutting apparatus and is characterized as comprising a cutting blade or knife formed to provide a cutting edge in the shape of a conical helix.

An essential feature of novelty of the present invention is the special character and construction of the cutting blade or knife and the principle of operation in slicing or cutting articles such as meats or other food products produced by the novel type of cutting blade referred to.

This invention may be embodied in machines for cutting or slicing various types of articles and substances but it is herein illustrated as embodied in a machine which is designed and particularly adapted for use in slicing meats, such as for instance; pork and beef loins and chops, bacon or any other similar products of the meat packing industry, with or without bones therein, as machines constructed in accordance with the present disclosure have been found to serve well in this use.

It is an object of this invention to provide a slicing or cutting apparatus, which employs a continuous cutting motion in operation as distinguished from intermittent or reciprocating motions usually employed in slicing operations.

Another object of this invention is to provide a machine or apparatus which is extremely simple in construction and relatively cheap to manufacture and one, the primary element of which is the cutting blade referred to with a rotary shaft for mounting said blade.

Another object is to provide a slicing or cutting apparatus which successfully performs cutting operations at a relatively high rate of speed, whereby the cutting capacity of the machine is greatly in excess of the capacity of the machines heretofore employed for cutting or slicing operations.

A further object of the invention is to provide slicing or cutting apparatus in which the location of the cutting action in producing a single cut or slice, travels axially with respect to the rotating cutting knife whereby a cutting contact between the knife

and the article being cut can be utilized to automatically and continuously feed the article into the cutting apparatus; or, the article being cut may be fed by independent means at a constant and continuous rate of speed into the cutting apparatus with the production of uniform straight slices or cuts by a continuous cutting motion.

A further object is to provide a cutting blade or knife shaped to provide a cutting edge formed as a conical helix in which the space between adjacent convolutions of the knife is greater than the thickness of the slices cut thereby.

In connection with the last stated object, it will readily appear that by employing a helical knife blade having more than one convolution, that two or more cutting blades will be caused to simultaneously penetrate the object being cut whereby the intervening slices or cuts are caused to occupy the spaces between adjacent convolutions of the blade, and that unless special provision is made in the construction of the blade to provide additional space between adjacent convolutions, the enclosed cut or slice will be wedged into a space which is less than the thickness of the slice by an amount equal to the thickness of one cutting blade. Accordingly, by the present invention, a knife is provided of a special construction designed to produce cuts or slices of less thickness than the space between blades whereby the undesirable wedging referred to is eliminated and the slices are free to readily fall away from the location of the cutting knife after the cutting operation is completed.

It is a further object of the present invention to provide a slicing or cutting apparatus of the character having a single rotary knife or cutting blade of the character described, which is adapted to simultaneously perform a plurality of duplicate cutting actions, whereby the capacity of the apparatus is not only increased through the higher efficiency of the high speed continuous operation, but is also increased as the multiple of the number of operations being carried on at any one time.

It is a further object to provide a slicing

or cutting apparatus comprising a rotary knife of the above described character in which the thickness of the slices is determined by the pitch of the helix and further in
 5 which the pitch may be varied or adjusted within limits whereby the thickness of the slices or cuts may be selected at will.

It is a further object of the present invention to provide in a cutting apparatus
 10 of the above described character, a knife having a cutting blade in the form of a conical helix constructed in such manner with relation to the article being cut so that in any single cutting operation, a portion
 15 of the knife remains in cutting contact with the article until the leading portion of the knife has penetrated the article in commencing a second cut, whereby a portion of the knife is always in contact with the article
 20 and the cutting blade also serves as a conveyor for automatically feeding the article being cut into the cutting mechanism.

It is a further object to provide a cutting apparatus having in combination with a
 25 knife, of the above described character, article holding means adapted to position and permit feeding of the article into the knife during the cutting operation at a constant and continuous rate of speed equal to the travel of the cutting contact between the
 30 blade and article whereby a cutting operation is carried on by continuous motion of the apparatus.

It is a further object of the present invention to provide a slicing apparatus having a plurality of cutting blades on a single shaft, each provided with a cutting edge formed as, or approximating a conical helix, together with means for positioning and
 40 feeding an article to be cut thereby at a constant and continuous rate of speed driven in synchronism with the rotations of the blades whereby the rate of advance of the article being cut is that which will
 45 advance the article an amount required to produce a number of slices equal to the number of blades on the shaft.

These and other objects not specifically enumerated are contemplated for the present invention and will readily appear to one skilled in the art, as the following description proceeds.

The present disclosure is given merely by way of example and is not to be considered
 55 as limiting the invention in any respect, as the scope of the invention should be determined from the appended claims and from an understanding of the present disclosure and an appreciation of the advantages which the invention produces therein.

The following description may be more readily understood by referring to the accompanying drawings in which—

Figure 1 is an elevational view partly in
 65 cross section of an apparatus constructed

in accordance with the present invention;

Figure 2 is a perspective view of the cutting blade illustrated in Figure 1;

Figure 3 is an enlarged cross sectional view of a portion of the cutting apparatus showing more accurately the relationship of the adjacent convolutions of the cutting blade with respect to the space therebetween and the pitch of the conical helix;

Figure 4 is an enlarged fragmentary view in cross section of a modified form of cutting mechanism having an adjustable mounting whereby the pitch of the conical helix may be varied at will;

Figure 5 is a plan view of a modified form of cutting apparatus provided with a continuous article holding and feeding means;

Figure 6 is an end elevational view of the cutting blade shown in Figure 5;

Figure 7 is a view corresponding to Figure 5, of a second type of cutting apparatus having a positive feed;

Figure 8 is a view similar to Figures 5 and 7 of a cutting apparatus having a positive continuous feed and a plurality of cutting blades adapted to cut a plurality of slices for each rotation of the cutting apparatus;

Figure 9 is an end elevational view of the cutting apparatus shown in Figure 8.

The type of apparatus which is disclosed in Figures 1 to 3 inclusive, will be described first.

In this form of invention, the helical cutting blade is provided with at least one complete convolution whereby the cutting contact between the knife and the article being cut also serves to convey or feed the article into the cutting mechanism automatically and at the proper rate of speed.

By referring to the drawings, it will be noted that this form of invention is illustrated as embodied in an apparatus comprising a shaft 10, mounted in suitable bearings 11, supported by any suitable frame construction, not shown. The shaft 10, is provided with a pulley or other gearing element 12 through which rotation is imparted to the shaft. On the shaft, a hub 13, is provided rigidly fixed, attached for rotation, which hub is provided with a spiral groove 14, which serves as a mounting for the cutting blade or knife.

As more clearly shown in Figure 2, it will be noted that the cutting blade 15, is formed and arranged as a spiral helix with the outer edge 16 thereof sharpened to provide the cutting or knife edge.

Furthermore, the portions of the blade between the cutting edge and the hub are inclined or arranged on an angle as shown in Figures 1 and 3, whereby the space designated "S" in Figure 3, between adjacent convolutions may be selected as greater than

the pitch of the helix, designated "P" in Figure 3.

The helical cutting blade may be mounted on the hub in any suitable manner such as welding in the groove 14 or by screws or similar fastening means and furthermore, the cutting blade may be made up in any desired manner such as by assembling a plurality of separately made parts.

Preferably, the cutting blade may be made up of a number of parts, each of which is substantially 360 degrees and formed to provide the final helical shape when the parts are assembled on the hub.

In associated relationship with the cutting mechanism, an article holder or positioning means 16 is preferably provided, positioned in the manner represented in Figure 1 so as to present articles to be cut by the apparatus in proper cutting relationship with the cutting blades. As the cutting edge conforms to a conical helix it will be observed that the axis normal to the cutting blade will be at a slight angle to the axis of the rotary shaft and therefore the article holding means 16 should be disposed at a slight angle so that the blades will slice or cut the article in transverse direction.

In the mechanism illustrated in Figure 1, it is particularly adapted for slicing articles of meat, such as pork loins or chops and is therein shown as the holder 16 in the form of a tube of a size and shape adapted to conveniently contain and position a loin or strip of pork chops.

By inspecting Figure 1, it will readily appear that in operation the rotary cutter is driven from a suitable source of power to rotate in that direction which causes the spiral circumference to continuously increase. When so rotated, any article to be cut, such as pork loin, is thrust forwardly in the tube 16 until the far end projects beyond the right hand edge of the tube as shown in Figure 1.

It will be noted that the tube is so adjusted with respect to the cutter that the upper surface of a pork loin when so presented is in position to be cut to some extent by a smaller portion of the helical cutter. When the pork loin is thrust forward sufficiently the upper surface thereof comes in contact with that portion of the rotary knife which is of smaller diameter which accordingly starts a slicing cut. As the cutter continues to rotate, the pork loin is drawn forward by the action of the helical blade in the cut already started so that eventually the slice is completed by a larger portion of the cutter.

In the meantime, after the knife has made a complete revolution, the smaller portion of the blade starts a second cut and so on to provide a continuous cutting action while the

loin is drawn through the tube 16 by the automatic feeding action of the cutter.

This action results in the rapid severance of successive slices until the loin or strip of chops has been completely cut or exhausted.

It is contemplated that a second loin or other article to be cut, can be introduced into the holder 16 and fed forwardly immediately behind the loin being cut so that after the exhaustion of a particular piece, the operation may be continued without interruption.

The advantage of providing the space "S" between adjacent convolutions of the cutting knife will be obvious from an inspection of Figure 1, where it will be noted that the thickness of individual slices is determined by the pitch of the helix so that by providing the pitch "P" less than space "S", the individual slices are free from binding in the space "S" between adjacent convolutions.

Inasmuch as the holder 16 occupies a relatively small space, it is contemplated that other work holders 16 may be positioned in corresponding locations around the shaft so that two, three, four or any convenient number of holders may be provided, and as many pork loins or other articles sliced simultaneously. In such cases, the only additional provision necessary is that of some catching or conveying means for receiving the slices from each holding unit.

Referring now particularly to Figure 4, it will be observed that a cutting mechanism is disclosed which is capable of varying the pitch of the cutting knife and therefore the thickness of slices to be cut. The blade 15' in this modification is mounted in a groove 20 provided in the outer surface of a spiral spring member 21. The spiral spring is designed to have a greater end to end length than the length it will normally occupy in a position of maximum pitch of the helix whereby in all positions, when mounted for cutting operation, the spring 21, will be under some degree of compression.

The convolutions of the spring 21 are formed as a true spiral whereby the corresponding convolutions of the cutting blade will be positioned to form a true conical helix. The hub portion of this modification comprises a member 22, which is designed to be keyed to a shaft for rotation and provided with internal threads 23 for receiving the threaded sleeve 24. The sleeve is provided with gear 25 on the outer edge thereof in mesh with a pinion 26, mounted for rotation in the socket 27, carried by the thrust collar 28. A straight sided opening 29 is provided in the gear, adapted to receive a crank or other tool for rotating the gear and in turn, the sleeve 24. It will thus appear that the rotation of these parts causes the sleeve to move axially with respect to the hub 22 and by contact with the thrust collar 28 to

impart a corresponding movement thereto.

This adjustment is effective to either compress or relax the spring 21, whereby it is caused to vary the distance between adjacent convolutions of the spring and knife and correspondingly, the pitch of the helical knife edge.

As it is desirable to maintain the exact pitch between all convolutions of the cutting knife, allowance should be made for the varying cross section of the cutting knife, so that the section modulus of the combined element namely, the spring 21 and the knife blades 15' about the axis of flexure shall be constant.

In practice, this may be done by varying the cross section of the spring 21 from point to point whereby the spring will be correspondingly weaker throughout those portions where increased strength is provided by the greater cross section of the cutting blade.

In the modification shown in Figure 5, a shaft 30 is provided mounted in bearing 31, held by the frame 32, which shaft is provided with a hub 33 having a cutting blade 34 mounted thereon with a cutting edge in the form of a conical helix. The construction is more clearly shown in Figure 6 from which it will be noted that this cutting blade is formed of less than one convolution. Accordingly, a positive feeding means is provided which comprises a clamp 35, having projections 36 thereon, adapted to engage and hold the article to be cut, such as a pork loin or other strip of meat, or the like, 37.

The direction of feed of the clamp 35 is determined by the threaded shaft 38 which has screw threaded engagement with the block 39, serving as a carrier for the clamp. The threaded shaft is mounted in suitable bearings carried by the frame 32.

It will be noted that the shaft 38 is disposed on a slight angle to shaft 30 for the purpose of feeding the article to be cut in a position normal to the effective cutting edge of the blade. The effective service of the cutting blade at any one time is at a slight angle to the axis of rotation due to the helical formation thereof.

Intermediate shafts 40 and 41 are provided mounted in bearings 42 and 43 respectively. The shaft 41 is provided with gears 44 and 45, the latter of which is in mesh with gear 46 on the shaft 30. Likewise, shaft 41 carries gears 47 and 48, the latter of which is in mesh with a gear 49 on the shaft 38.

Gears 44 and 47 are in mesh whereby the rotation of the driving shaft 30 by means of suitable power applied to the gearing element 50 on the end thereof, will serve to rotate the shaft 38 so as to effect a forward feeding of the clamp and the article being cut. The gearing in this modification is so arranged with respect to the pitch of the

threads on shaft 38 that the article being cut will be fed forwardly for each rotation of the cutting knife an amount equal to the pitch of the cutting knife, whereby the feeding action is constant and continuous.

It will be obvious that this type of mechanism eliminates all necessity for reciprocating or intermittently moving parts and assures with great accuracy, slices of constant, uniform thickness.

The modification illustrated in Figure 7 is quite similar in construction and operation with the exception that the clamp 60 is held by a carrier 61 which slides on a bar 62. Bar 62 is stationary and the forward feeding movement is imparted to the carrier by means of the yoke 63 which engages the pin 64, mounted on the carrier. The yoke in this modification is provided with a threaded hub 65 in engagement with the threaded shaft 66 which is driven by means of gears 67 and 68 from the main shaft 70, on which the cutter is mounted. In this form, power may be transmitted to the shaft 70 through any suitable mechanism not shown, whereby the pork loin or other article being cut will be advanced in the manner described in Figure 6.

Here also, the gearing is adjusted to provide the forward feeding of the article being cut at a rate equal to the pitch of the feeding screw for each revolution of the main shaft 70.

In the modification shown in Figures 8 and 9, a plurality of cutting blades 80 are shown mounted on a hub 90, fixed to rotate with the shaft 91. The shaft 91 is held in suitable bearings 92 in the frame 93. In this form, the cutting blades which are less than one hundred and eighty degrees in size, are located at an angle as shown in Figure 8, but are of substantially straight formation instead of strictly conforming to the formation of a conical helix. This form is shown by way of a suitable embodiment of the invention and the deviation from the strictly helical form is permitted for the purpose of manufacturing convenience and with the result that the variance is insufficient to produce any substantial difference in the cutting action.

The angular disposition of the cutting blade is such that the point of cutting contact at any one time advances forwardly in substantially the same manner as that of a true helix. It will therefore appear that where the blades are of relatively small arcs in size, that variance to the straight but angularly disposed blades may be permitted without substantial change or effect upon the operation.

In this form, two cuts or slices are completed for each rotation of the shaft 91 and accordingly, the clamp 94 holding the loin or other article 95, is fed forwardly at a

rate sufficient to expose a quantity of the article to the knives sufficient to produce two slices.

In other words, the rate of feed is twice that of the rate in the device shown in Figures 5 and 7. The forward feeding is accomplished by means of a rotary threaded shaft 96, on which is mounted the threaded collar 97, having a carrier 98 for the clamp 94 rigidly attached thereto. The shaft 96 derives its rotary motion from a gear 97 and chain 98 in mesh with a gear 99 mounted on shaft 95. The shaft 95 may be rotated by any suitable gearing means from a source of power not shown.

As shown in Figure 9, a suitable tray 100 may be positioned with respect to the cutting blades to maintain the loin or other article in proper feeding position with respect thereto.

From the above description of the various modifications of this invention, it will readily appear that the applicant has disclosed a new and improved type of slicing and cutting apparatus which possesses the advantages enumerated therefor and fully accomplishes all of the above stated objects.

The scope of this invention may be determined from the appended claims.

I claim:

1. A cutting machine comprising a rotary knife, said knife having blade portions in axially spaced relation adapted to present portions for simultaneous cutting action on opposite sides of a single slice or cut, the space between said blade portions being greater than the axial distance between the cutting edges of said blade portions.

2. A cutting machine comprising a rotary knife, said knife having blade portions in axially spaced relation adapted to present portions for simultaneous cutting action on opposite sides of a single slice or cut, said blade portions being angularly disposed with respect to the axis of said knife with the space therebetween greater than the distance between the cutting edges thereof in directions parallel with the axis of said knife.

3. A cutting machine of the character described comprising a rotary knife shaped to provide a cutting edge formed as a conical helix of more than one convolution, with the space between adjacent convolutions greater than the pitch of said conical helix.

4. A cutting machine of the character described comprising a rotary knife shaped to provide a cutting edge formed as a conical helix of one or more convolutions and with the convolutions of the knife disposed at an angle to the axis of rotation with the space therebetween in excess of the pitch of said helix.

5. A cutting machine of the character described comprising in combination a rotary

knife shaped to provide a cutting edge formed as a conical helix and an article holding and feeding means driven in synchronism with said knife for positively feeding articles to be cut into the cutting path of said knife at a rate effective to feed said article a distance equal to the pitch of said helix for each rotation of said knife, the normal distance between blade portions of said knife being greater than the pitch to provide clearance for said slices.

6. A cutting machine of the character described comprising in combination, a rotary knife shaped to provide a cutting edge formed as a conical helix and an article holding and feeding means driven in synchronism with said knife for positively feeding articles to be cut into the cutting path of said knife, said means acting to feed said article in a direction angular to the axis of said knife and normal to the effective cutting portion thereof.

7. A cutting machine of the character described comprising a rotary knife shaped to provide a cutting edge formed as a conical helix of one or more convolutions with the space between adjacent convolutions greater than the pitch of the helix and means for holding and permitting feeding of an article through the cutting path of said knife, whereby said knife acts to feed the article after the cutting action begins.

8. A cutting machine of the character described comprising in combination a rotary knife shaped to provide a cutting edge formed as a conical helix having less than one convolution and an article holding and feeding means driven in synchronism with said knife for positively feeding articles to be cut into the cutting path of said knife at a rate effective to feed said article a distance equal to the pitch of said helix for each rotation of said knife, said means acting to feed said article in a direction angularly to the axis of said knife and substantially normal to said cutting edge.

9. A cutting machine of the character described comprising a rotary knife shaped to provide a cutting edge formed as a conical helix of more than one convolution and adjustable means serving as a mounting for the blades of said knife for varying the space between adjacent convolutions and the pitch of said helix.

10. A rotary knife for use with machines of the character described, comprising a hub, a spiral spring element mounted on said hub, and means abutting said spring adjustable axially thereof and a knife blade formed as a conical helix mounted in said spiral spring element.

11. A rotary knife for use with machines of the character described, comprising a hub, a spiral spring element mounted on said hub, and means abutting said spring adjustable

ble axially thereof and a knife blade formed as a conical helix mounted in said spiral spring element, said spiral spring element being mounted under initial compression when said rotary knife is assembled for operation.

12. A cutting machine of the character described comprising in combination a rotary knife shaped to provide a cutting edge formed as a conical helix, and an article holding means for directing the line of feed of said article into said knife, said means being constructed and disposed to cause said article to feed in a direction angularly to the axis of said knife and substantially normal to the cutting edge thereof with the pitch of the cutting edge equal to the thickness of the slices to be cut.

13. A meat slicer of the rotary type having a central supporting member or hub rotatable about a longitudinally extending axis thereof and a cutting blade structure suitably secured in place on and in respect to the central supporting member or hub, which cutting blade structure provides successive cutting blade sections proper, the successive cutting edge sections of which in effect define a conical helix with the small end at the rear section of the cutting blade structure, the cutting blade proper of the cutting blade structure being shaped so that it comprises a plurality of blade convolutions which in cross section on any of the radial-axial planes have an inclination in an outward and rearward direction and show a bevelling of the peripheral rear face portion of the blade so as to substantially provide the cutting edge of the meat slices.

14. A meat slicer as per claim 13 wherein the shortest distance between adjacent blade convolutions is greater than the cutting pitch or slice thickness as determined by the cutting edges.

15. A rotary meat slicing element comprising in combination a hub rotatable about a longitudinally extending axis thereof and suitably secured in place on said hub, a cutting blade construction providing a cutting blade having a cutting edge in the form of a conical helix with the small end of the helix rearmost, and in which cutting element the general slope or inclination of the blade sections cut by any radial-axial plane is in a general outward and moderate rearward direction whereby the shortest distance between adjacent convolutions of the blade is greater than the cutting pitch or slice thickness as defined by the cutting edge as the slicing element rotates.

16. A cutter as defined in claim 15 in which the exposed body portion of each blade section is substantially of the same longitudinal thickness except in the region of the peripheral portion thereof which is ta-

pered to the cutting edge because of the rear face being bevelled.

17. A cutting machine of the character described comprising a rotary knife having a shaft, a spirally arranged blade on said shaft shaped to provide a cutting edge formed as a conical helix and disposed so that said blade is at an angle to the perpendicular about the axis of said shaft, the pitch of said helix being equal to the thickness of the slices to be cut.

18. A cutting machine of the character described comprising a rotary knife having a shaft, a spirally arranged blade on said shaft shaped to provide a cutting edge formed as a conical helix of one or more convolutions and disposed so that said blade is at an angle to the perpendicular about the axis of said shaft, the pitch of said helix being equal to the thickness of the slices to be cut.

Signed at Chicago, Illinois, this 6th day of August, 1930.

CHARLES T. WALTER.