May 16, 1944. W. E. URSCHEL ET AL 2,349,212

DICING MACHINE

Filed Aug. 25, 1941 5 Sheets-Sheet 1

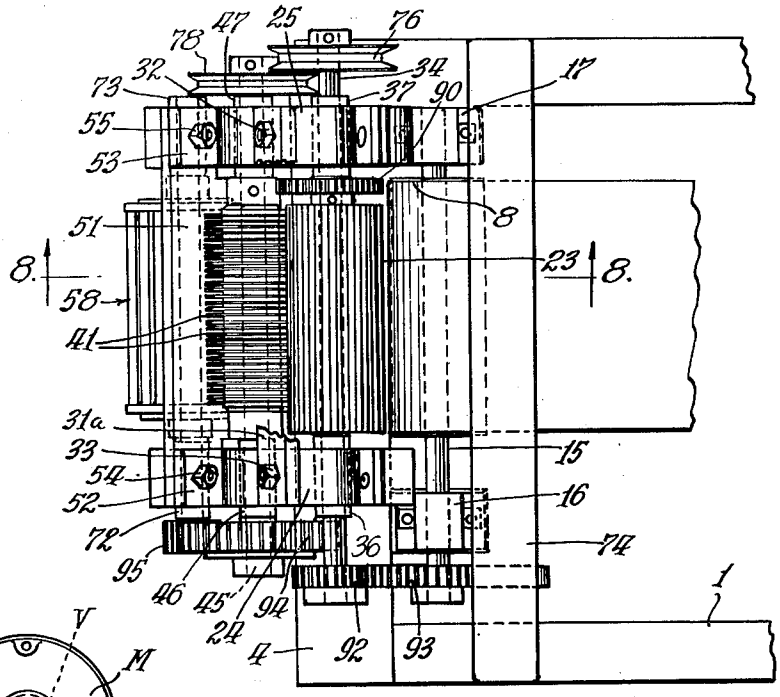


Fig. 2.

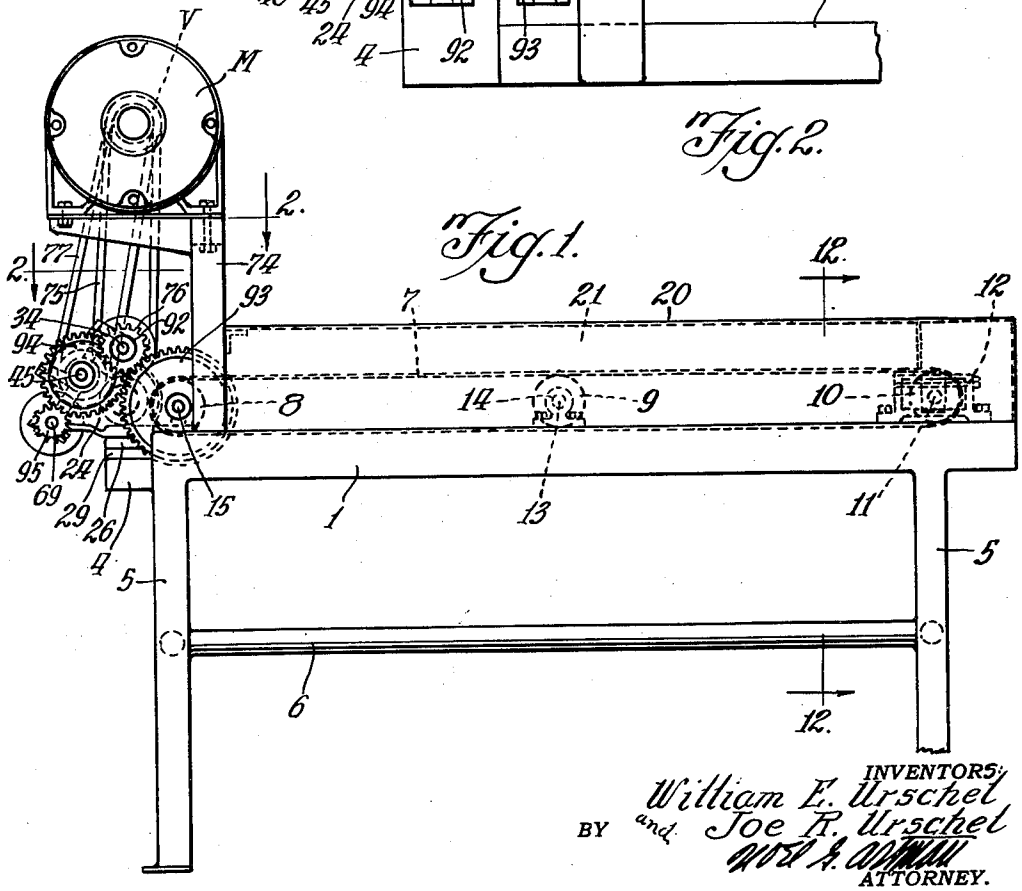


Fig. 1.

INVENTORS:
William E. Urschel
BY and Joe R. Urschel
ATTORNEY.

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DICING MACHINE

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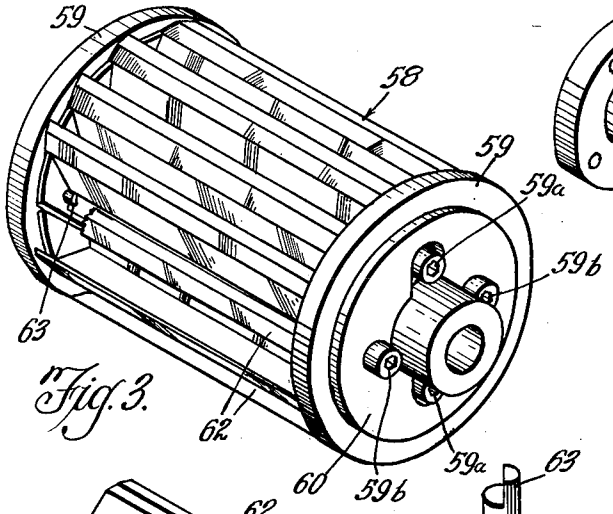


Fig. 3.

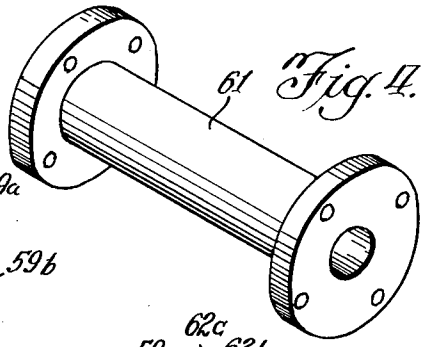


Fig. 4.

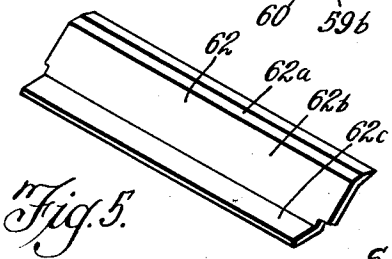


Fig. 5.

Fig. 6.

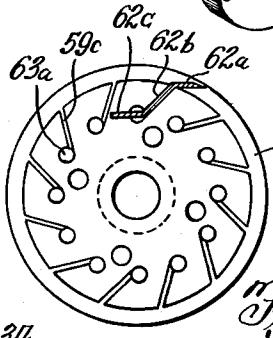


Fig. 7.

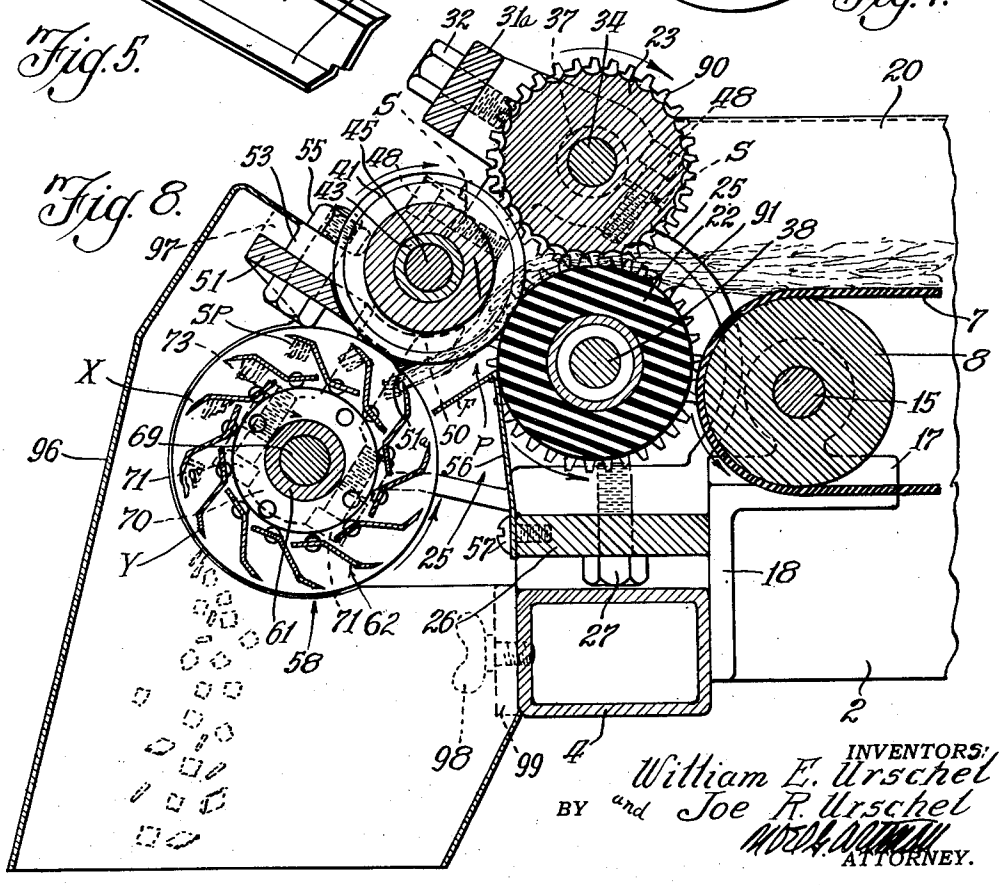


Fig. 8.

INVENTORS:
William E. Urschel
and Joe R. Urschel
BY
ATTORNEY.

May 16, 1944. W. E. URSCHEL ET AL 2,349,212

DICING MACHINE

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Fig. 9.

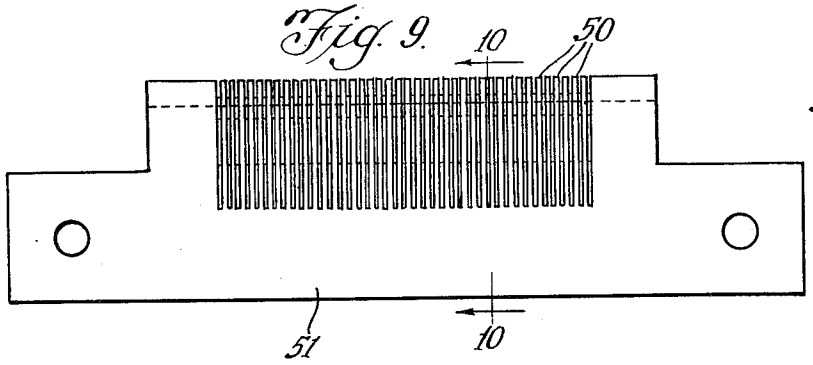


Fig. 10.

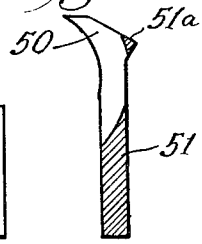
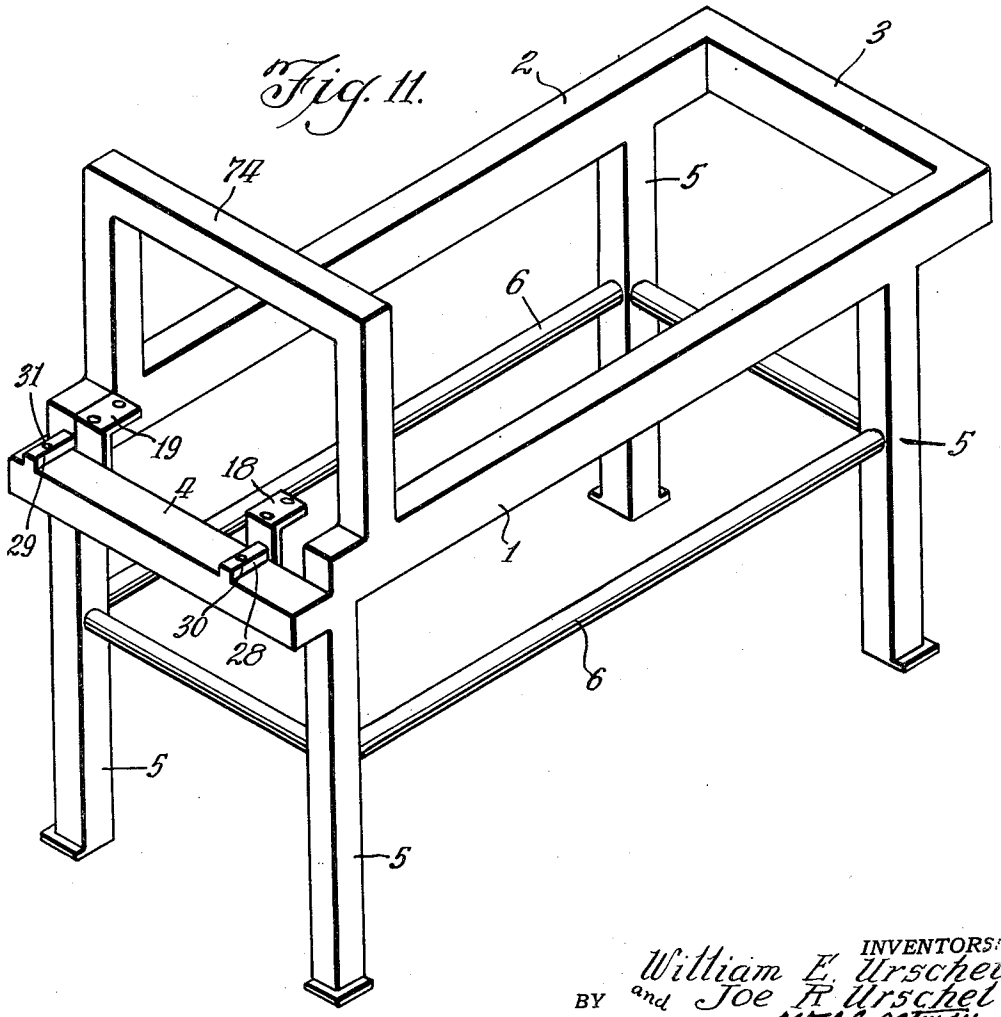


Fig. 11.



INVENTORS:
William E. Urschel
and Joe R. Urschel
BY
ATTORNEY.

May 16, 1944. W. E. URSCHEL ET AL 2,349,212

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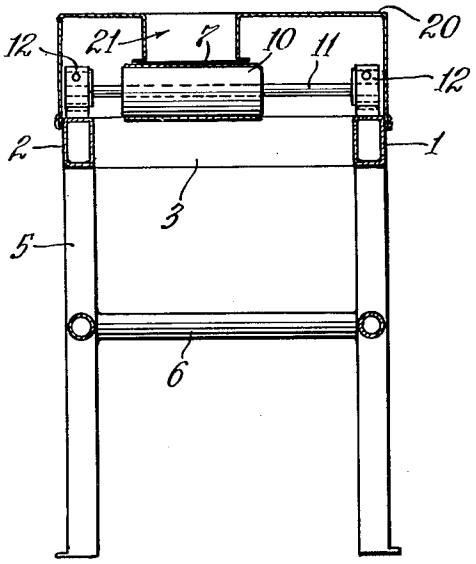


Fig. 12.

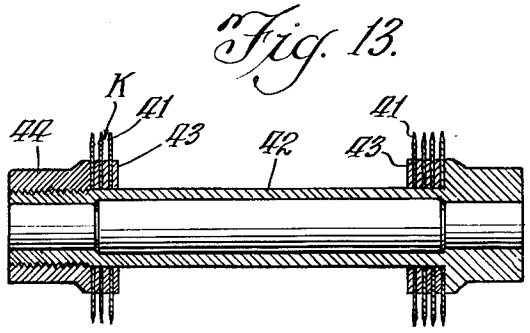
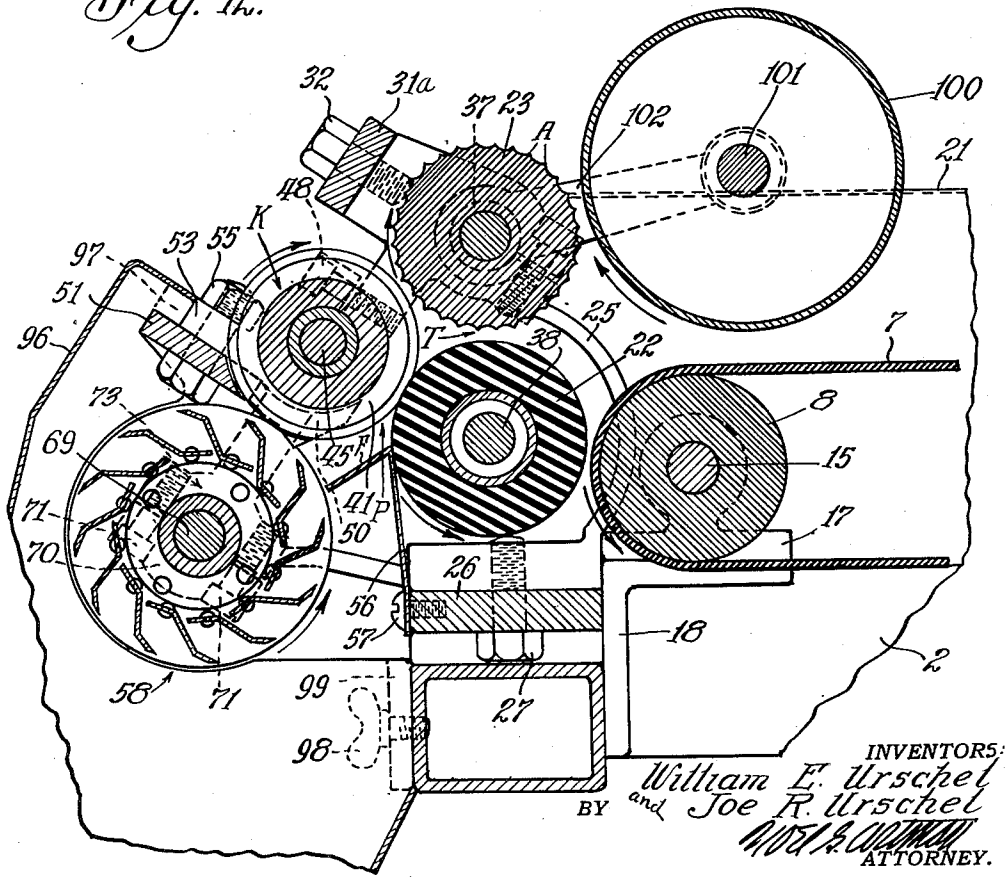


Fig. 13.

Fig. 14.



INVENTORS:
William E. Urschel
and Joe R. Urschel
BY
ATTORNEY.

May 16, 1944. W. E. URSCHEL ET AL 2,349,212

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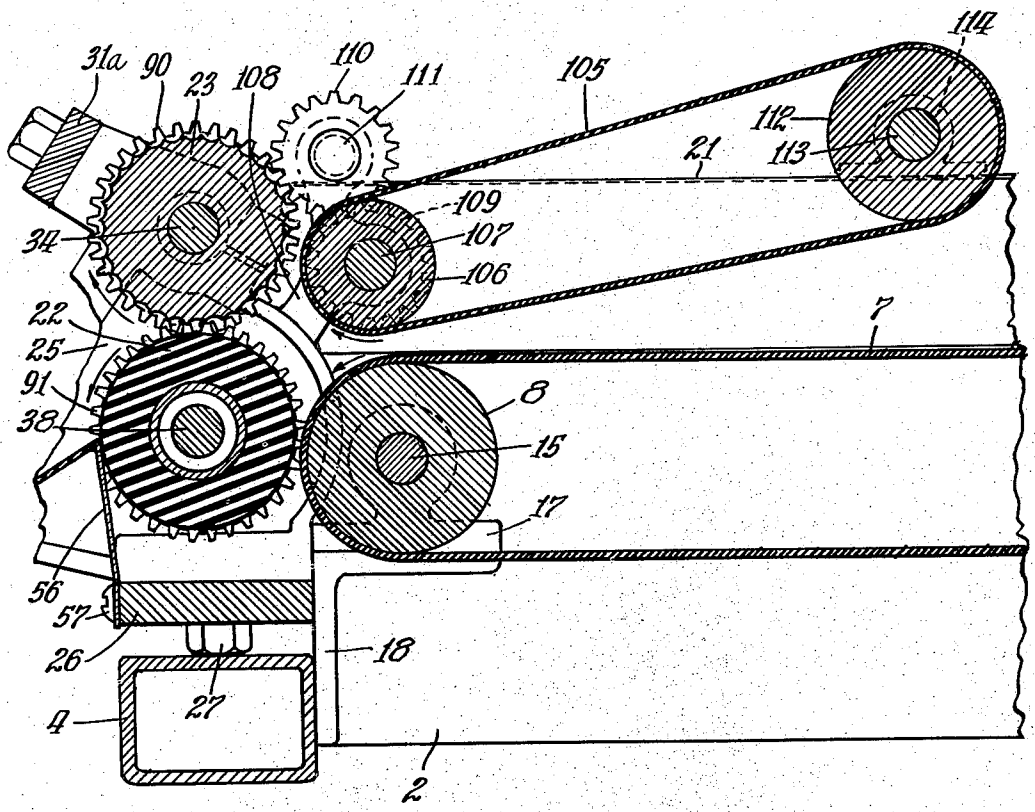


Fig. 15.

INVENTORS:
William E. Urschel
BY and Joe R. Urschel
ATTORNEY.

Patented May 16, 1944 2,349,212

UNITED STATES PATENT OFFICE

2,349,212

DICING MACHINE

William E. Urschel and Joe R. Urschel,
Valparaiso, Ind.

Application August 25, 1941, Serial No. 408,160

4 Claims. (Cl. 146—78)

This invention relates generally to a machine for feeding material substantially in web, sheet or ribbon form successively to means for cutting the material into narrow strips and thence to means for cutting the strips into square, rectangular or cubical pieces. The invention contemplates such a machine operable upon any cuttable web although the embodiment herein shown and described is particularly adapted to dice bulky vegetable materials of which the individual units or pieces are stalk or leaf-like in character or are reasonably flat such as spinach, orange peel, celery and beans.

While the shape of individual particles cut from material processed in the present machine may vary in shape from an exact cube because the thickness of the articles as stalks, leaves and peels from which they are carved are thinner than the spacing of transverse and longitudinal cuts taken through these articles, it will be understood from the ensuing description that by arranging the spacing of such transverse and longitudinal cuts, as by changing the number of knives, the degree to which the particles approach the shape of perfect cubes can be predetermined. It is intended, therefore, for convenience, that the term "dicing" as used herein shall be given a connotation sufficiently broad to include substantially flat pieces normally loosely referred to in terms implying principally two dimensions, as, for instance, "square" or "rectangular."

An important general object of this invention is the provision of an improved, simple and effective machine especially suited for processing in bulk a material consisting of loosely associated pieces, by organizing such material into a stream, compressing the stream of loosely associated pieces into a web while advancing it through the machine, cutting longitudinal slits in the advancing web to divide it into strips, and cutting the strips into sections of desired length whereby the pieces making up the bulk material are ultimately cut into diced particles of the aforesaid character.

Another important object is the provision of a dicing machine expediently operable upon loosely associated pieces of cuttable material and wherein there is a novel structure and arrangement of parts for compressing the particles into a mat or web while advancing them in the machine.

A further object is the provision of a new combination of cutting-block roller and knife gang cooperable for cutting the generally flat body of material into strips while rotating in such a direction as to urge the same along its course through the machine.

The invention further contemplates a unique combination wherein the cutting-block roller also forms a side wall portion of a throat in which the material is compressed and preparatory to being fed into the aforesaid knife gang.

An additional object is the provision of a new compressor roller of which the cylindrical periphery is configurated in a fashion enabling it to feedingly grip the material to be compressed thereby and in a manner minimizing crushing of such material.

The above and other desirable objects inherent in and encompassed by the invention will become apparent when fully understanding the preferred embodiment thereof hereinafter described and shown in the accompanying drawings wherein:

Fig. 1 is a side elevational view of a machine constructed according to the principles of the present invention;

Fig. 2 is a horizontal view taken substantially upon the line 2—2 in Fig. 1 and showing in plan the cutting and compressing means of the machine.

Fig. 3 is a perspective view of a dicing knife assembly;

Fig. 4 is a perspective view of a spool constituting a core about which the assembly in Fig. 3 is formed;

Fig. 5 is a perspective view of one of the knife blades of the dicing knife assembly;

Fig. 6 is a perspective view of a knife retaining pin used in the assembly of Fig. 3;

Fig. 7 is a side view showing the inner face of an end plates of the knife assembly in Fig. 3;

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 2;

Fig. 9 is a view looking at the side of a shear plate cooperable with the dicing knife assembly and having stripper fingers thereon disposed between the knives of a disc knife gang shown individually in Figs. 2 and 13;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is a perspective view of the frame of the machine;

Fig. 12 is a transverse sectional view of the machine frame, taken as indicated by the line 12—12 in Fig. 1;

Fig. 13 is a longitudinal sectional view taken through the aforesaid gang of disc knives, only

part of the knives being shown to avoid duplicity;

Fig. 14 is a view similar to Fig. 8 and showing the employment of a compressing roller when operating on more bulky substances;

Fig. 15 is also a view similar to Fig. 8 but including a compressor belt.

Referring now to Figs. 1, 11 and 12, a frame for the machine will be seen to include a pair of side members 1 and 2 connected at their ends by end members 3 and 4. Each of these members is formed of tubing, square in cross section, as are four frame legs each designated by the character 5. Lateral bracing for the legs 5 is provided by tubular rods 6. These various parts of the frame are fastened together by welding although any common fastening means may be used.

An endless feed belt 7 is carried on rollers 8, 9 and 10 supported between the frame side members 1 and 2. Roller 10 is journalled on a rod 11 which is adjustably mounted in conventional belt take-up devices 12 bolted to the frame members 1 and 2. The middle roller 9 is journalled on a rod 13 held in brackets 14 bolted to said frame members 1 and 2, while the drive roller 8 is fixed to shaft 15 which is journaled in bearing units 16 and 17 fixed upon the frame. These bearing units are respectively bolted to brackets 18 and 19, Fig. 11, which are welded to the frame end piece 4. A power train, later described, for driving the belt 7 includes a gear 93, Figs. 1 and 2, rotatively fixed upon an end of the shaft 15.

A feeding apron 20 preferably made of sheet metal serves as a cover for the machine frame and is shaped to embody a feeding well 21 in vertical alignment with the belt 7 whereby to coact with the belt in forming a recess in which loosely associated pieces such as spinach leaves, celery stalks, peel of citrous fruits and the like may be marshalled into a stream having a depth regulatable by gauging the upper surface thereof with respect to the flat top portion of the apron. Said apron further serves as a platform on which the material consisting of the loosely associated constituents may be piled preparatory to being deposited upon the upper flight of the belt for discharge by the latter into the machine as a continuously flowing stream, uniform in breadth and depth.

From the feed belt 7 the stream of loosely associated pieces are discharged into a throat T formed between a cutting-block roller 22 and a companion compressor and feed roller 23. Said roller 22 is called a cutting-block roller because of its cooperation with a gang of disc knives 41 hereinafter described, although this roller cooperates with the companion roller 23 in compressing the stream of loosely associated pieces into a comparatively thin mat or web and in feeding the latter onward in the machine. Such compression of the stream of material presses the individual pieces into a sort of structural interfabrication, the resulting web thus having sufficient self-support as a unitary body to receive propelling force from the rollers 22 and 23 for feeding such web forcibly into a passageway of which opposite side portions are formed by the parallel and spacedly disposed rollers 22 and K where the web is cut longitudinally by the aforesaid disc knives 41 into a plurality of strips. The compressor roller 23 is fluted in its cylindrical periphery as illustrated in Figs. 2, 8, 14 and 15, wherefore the resulting fillets A facilitate gripping of the stream of material fed from the belt 7. However, said fillets are sufficiently rounded to preclude their cutting through any of the material while it is compressed between the rollers 22 and 23, they serving to increase the traction of the roller 23 with the compressed material whereby it can feed the aforesaid web into the passageway between the rollers 22 and K with greater positiveness. After the loosely associated pieces have been compressed between the rollers 22 and 23 they cling together with sufficient firmness to receive this driving force from said rollers without disintegration from their composite web-like body.

The compressor and feed rollers 22 and 23 (of which the roller 22 is also a cutting-block roller) and the knife roller K are all arranged in parallelism between multiple-bearing brackets 24 and 25 which are mounted upon opposite ends of a bar 26, Fig. 8, to which they are secured by capscrews 27, and said bar is fastened to the frame end piece 4 on pads 28 and 29, Fig. 11, by capscrews (not shown) turned into threaded holes 30 and 31. Another bar 31*a* secured between the brackets 24 and 25 by capscrews 32 and 33 help retain said brackets in spaced parallelism. The upper feed roller 23 is fixed on a shaft 34 which is journaled in bearings 36 and 37 of the brackets 24 and 25, Figs. 2 and 8, whereas the companion roller 22 is fixed on a shaft 38 journaled in other suitable bearings (not shown) respectively in the said brackets.

Referring now to Fig. 13, the assembly comprising the disc knives 41 is built about an arbor 42 on which said knives are mounted and held in spaced relation by rings 43. A collar 44 in threaded relation with one end of the arbor clamps the knives 41 and the spacing rings 43 securely on the arbor 42, said arbor and the rings 43 then forming the aforesaid roller K. The arbor 42 is secured to a shaft 45 of which opposite end sections are journaled in bearings 46 and 47, Fig. 2, in the multiple-bearing brackets 24 and 25. Sections of the brackets 24 and 25 surrounding the bearings therein are split as shown at S in the bracket 25 in Fig. 8. These split sections are tightened upon their respective bearings 36, 37, 46 and 47 by the conventional use of hollow headed set screws 48.

In Fig. 8, it can be seen that the cutting-block roller 22 is in contact with sharpened edge portions of the disc knives 41. The portion of said roller in contact with the knives 41 is made of vulcanized rubber or other suitable material capable of yielding slightly under pressure from the knives to avoid dulling the knife edges. Since the knives engage the cutting-block roller 22, the material passing between the rollers K and 22 is cut clean and entirely through.

To force the strips, into which the compressed web is cut, from between the disc knives and to direct the said strips into an assembly of rotating dicing knives 62, ejecting fingers 50 are positioned between the disc knives 41. These ejecting fingers 50 are integral with a shear plate 51 shown individually in Figs. 9 and 10 and which is secured to projections 52 and 53 on bearing brackets 24 and 25 by means of bolts 54 and 55 as illustrated in Figs. 2 and 8. The lower edges of fingers 50 as viewed in Fig. 8 are in opposed spaced relation with a flange F on a guide plate 56 to form a continuation of the passage P between the rollers 22 and K. Said guide plate is secured to the bar 26, Fig. 8, as by screws 57.

To cut the strips formed by the knives 41 into cubes or small square or rectangular pieces, a

rotatable assembly 58 of dicing knives 62 is positioned to act upon said strips as they are discharged from the passage P. Since this knife assembly and its mode of operation are fully described in the Patent No. 2,242,557, the present reference thereto will be brief. Said knife assembly 58 is keyed to a shaft 69 which is journaled in pillow bearings 72 and 73, Figs. 2 and 8 on bearing brackets 24 and 25. Said bearings 72 and 73 include counterpart caps 70 secured to the brackets 24 and 25 by hollow head capscrews 71. The dicing knife assembly is built about a cylindrical core 61, Figs. 4 and 8, which has dicing knife supporting heads 59 secured to opposite flanged ends thereof as by means of capscrews 59a, Fig. 3. Additional capscrews 59b extend through plates 60 (one being shown in Fig. 3) as well as through the heads 59 for holding said plates and heads upon the flanged ends of the core 61. Grooves 59c within the inner opposed faces of the head members 59 are for receiving the ends of the dicing knives 62 in the manner illustrated in Figs. 3 and 7. Shouldered pins 63 are inserted inwardly through holes 63a at the inner ends of the grooves 59c in the heads 59, with the shouldered portions of these pins against sections of the dicing blades 62 to prevent movement of the blades endwise outwardly in said grooves, said pins being assembled with the blades as illustrated in Figs. 3 and 7 and being held seated within their respective holes 63a by the plates 60. Each knife 62 has a cutting edge portion 62a disposed angularly to a central portion 62b and a flange-like shank portion 62c disposed generally in parallelism with the portion 62a.

In the operation of the dicing knife assembly, such assembly is rotated counter-clockwise as viewed in Fig. 8 to carry the cutting edges of the blades 62 in close proximity with the shearing edge 51a of the shear plate 51. The speed of the dicing knife assembly is so regulated with respect to that of the rollers 22 and 23 and K that pieces of predetermined length will be cut from the strips of the material issuing from the passage P. Since the strip material issues from the passage P at considerable speed there will be a tendency for the inertia of the severed pieces SP to carry them radially inwardly of the dicing knife assembly, but this tendency of said pieces SP is overcome by the movement and shape of the dicing knives. When the cutting edge of a dicing knife severs a piece SP from its strip, said piece is deflected transversely of the course followed through the passage P, the aforesaid inertia causing the piece to move radially inwardly of the dicing knife assembly far enough to engage the central portion 62b of its associated knife, but because of the centrifugal component of force imparted to the piece by the orbitally moved knife said piece will be decelerated in its said radial inward movement wherefore by the time it reaches its respective knife section 62b it will engage the same with little force, thus avoiding bruising of the piece; and, thereafter, when the centrifugal force component predominates, the piece will reverse its direction of movement radially of said knife assembly and will eventually be discharged radially outwardly of such assembly. This operation of the dicing knife blades is illustrated in Fig. 8 where a piece SP of the material is shown to be adjacently to the edge of its knife at the instant it is cut from its strip in the passage P. By the time a knife is moved from the severing position to some such position as X the severed piece will have moved its maximum distance radially inwardly of the knife assembly and will begin to move radially outwardly so that by the time the knife reaches some such position as the position Y the piece will be discharged from the knife assembly.

The various parts of the machine may be driven by a motor M, Fig. 1, mounted over the frame on a frame bridge 74. A double V-belt pulley V is mounted on the motor shaft, and from this pulley a V-belt 75 drives a pulley 76 which is keyed on an end of the shaft 34 for thus driving the fluted compressor feed roller 23. A spur gear 90, Figs. 2 and 8, keyed to the shaft 34 drives a gear 91 Fig. 8 which is keyed to the shaft 38 on which the cutting-block and compressor feed roller 22 is secured. A spur gear 92, Fig. 2, is keyed to the other end of the shaft 34 in driving relation with a gear 93, which is fixed to the shaft 15 for driving the belt roller 8. The diameters of the pulleys are so chosen that the angular velocity of the knife roller K exceeds that of the cutting-block roller 22 whereby the cylindrical periphery of roller K will have a curvilinear speed at least equal to and preferably slightly exceeding that of the roller 22. When rotated at this relative speed the roller K will exert sufficient feeding pull upon the faster-moving outer periphery of the web at the section, where it is curved about the roller 22 for movement therewith, to keep both sides of the web moving at the same speed and avoid accumulation and bunching of material from the upper or outer peripheral part of the web section between the rollers 23 and K.

Another V-belt, 77, driven from the motor shaft pulley V, drives a pulley 78, Fig. 2, keyed to disc-knife drive shaft 45, Figs. 1, 8 and 14 and thus causes rotation of the disc knives 41. A spur gear 94, Fig. 2, keyed to shaft 45 drives a spur gear 95 securely fixed to the drive shaft 69 for the dicing knife assembly. The various parts are driven in the directions indicated by the arrows in Figs. 8 and 14 and at such speed to afford a continuous passage of material through the machine.

The rotary knife assembly is shrouded by a hood and discharge spout unit supported from the shear plate 51 by studs 97 (one being shown in dotted outline in Figs. 8 and 14) depending from said unit and also from the end frame member 4 by thumb screws 98 through ears 99.

To improve the efficiency of the machine when operating on more bulky substances, such as certain kinds of leaf vegetables, a packing or compressing roller 100 will be used in cooperative relation with the belt 7 near the rollers 22 and 23; see Fig. 14. The purpose of such a roller is to effect an initial packing of the material so that a greater quantity thereof may be fed more gently into the rollers 22 and 23. Said roller is journalled on a rod 101 carried at its end by arms 102 pivotably mounted on projecting portions of bearings 36 and 37. This construction permits the roller to exert pressure due to its weight upon the material on the feed belt and to adjust itself to any variation in the thickness of the material on the belt.

Instead of the roller 100, a compressor belt 105, Fig. 15, may be used. This compressor belt is mounted over the feed belt 7 in such a manner that the space between the belts is gradually reduced as the rollers 22 and 23 are approached

whereby the material is gradually compressed as it is delivered to said rollers. A drive roller 106 for belt 105 is rotatively fixed on a shaft 107 which is journaled in bearing brackets 108 respectively attached to the brackets 24 and 25. A spur gear 109 keyed to the shaft 107 is driven by the gear 90 through an idler gear 110 journaled on a stud 111 fixed in the bracket 108. An idler roller 112 for the belt 105 is journaled on a rod 113 supported at its ends in brackets 114 bolted to the sheet metal apron 21.

While we have herein shown and described preferred embodiments with the view of fully illustrating the invention, it should be understood that the invention extends to other forms, arrangements, structures and details falling within the scope and spirit thereof and not sacrificing all of its material advantages.

We claim:

1. In a cutting machine for dividing a cuttable material initially constituting a compressible body of loosely associated parts, a feeding throat for advancing a stream of the compressible material therethrough while compressing the same into a web, means for shaping loosely associated parts of the material into said stream and directing the same into said throat, said throat comprising parallel rollers spaced apart to present axially extending portions in opposed relation for forming opposite side wall portions thereof, one of said rollers being provided with narrow rib-like formations spaced apart circumferentially and extending axially thereof, the other of said rollers being a cutting-block roller, means for rotating said rollers in the direction to advance the material therebetween through the throat, a knife roller at the discharge end of said throat and in spaced parallelism with the cutting-block roller to provide a space between said rollers for receiving the web as it is discharged from the throat, a gang of knives rotatively fixed upon the knife roller and having circular cutting edges circumscribing such roller and spaced apart axially thereof, said knives being sufficiently large in diameter to bridge the space between said roller for placing their cutting edges in complemental cutting relation with the periphery of the cutting-block roller, and means for rotating the knife roller oppositely to the cutting-block roller whereby said roller and the knives thereon cooperate with the cutting-block roller in cutting the web into strips and in advancing the material through said space between these rollers.

2. In a cutting machine for dividing a cuttable material initially constituting a compressible body of loosely assocated parts, a cutting-block roller, compressor and knife rollers parallel with the cutting-block roller, said compressor and knife rollers being spaced circumferentially of the cutting-block roller and also being spaced a short distance from the periphery of the cutting-block roller to effect a compressor throat between said cutting-block roller and the compressor roller and a passage between said cutting-block roller and the knife roller, means for feeding a stream of the material into said throat, means for rotating the compressor and cutting-block rollers in opposite directions for advancing said stream through the throat while compressing the same into a web, said passage being adapted to receive said web as it emerges from said throat whereby the web is guided in a curved path about the periphery of the cutting-block roller causing the radially outermost surface of said web to move at greater speed than the surface of said web adjacently to the cutting-block roller, means for rotating the knife roller at a speed causing its circumferential periphery to move at a speed no less than the speed of said radially outermost surface of said web to prevent accumulation and bunching of material from said outermost portion of said web between the knife and compressor rollers, and a gang of knives rotatively fixed upon the knife roller and having circular cutting edges circumscribing such roller and spaced apart axially thereof, said knives being sufficiently large in diameter to bridge the space between said knife and cutting-block rollers for placing said cutting edges in complemental cutting relation with the periphery of the cutting-block roller.

3. In a cutting machine for dividing a cuttable material initially constituting a compressible body of loosely associated parts, a cutting-block roller, compressor and knife rollers parallel with the cutting-block roller, said compressor and knife rollers being spaced circumferentially of the cutting-block roller and also being spaced a short distance from the periphery of the cutting-block roller in forming a compressor throat between said cutting-block roller and the compressor roller and a passage between said cutting-block roller and the knife roller, means for feeding a stream of the material into said throat, means for rotating the compressor and cutting-block rollers in opposite directions for advancing said stream through the throat while compressing the same into a web, said passage being adapted to receive said web as it emerges from said throat whereby the web is guided in a curved path about the periphery of the cutting-block roller causing the radially outermost surface of said web to move at greater speed than the surface of said web adjacently to the cutting-block roller, means for rotating the knife roller at a speed causing its circumferential periphery to move at a speed substantially the same as that of said radially outermost surface of said web to prevent accumulation and bunching of material from said outermost portion of said web between the knife and compressor rollers, and a gang of knives rotatively fixed upon the knife roller and having circular cutting edges circumscribing such roller and spaced apart axially thereof, said knives being sufficiently large in diameter to bridge the space between said knife and cutting-block rollers for placing said cutting edges in complemental cutting relation with the periphery of the cutting-block roller.

4. In a cutting machine for dicing a cuttable material initially consisting of loosely associated compressible parts, a feeding throat for advancing a stream of such material longitudinally therethrough while compressing the same into a web, parallel coacting compressor and cutting-block rollers arranged transversely of the throat and having opposed peripheral portions forming opposite side wall portions of said throat, one of said rollers having narrow ribs extending axially thereof and spaced circumferentially thereabout, means for rotating said rollers to advance their throat side wall portions longitudinally of the throat to thus advance said stream therethrough as aforesaid, a knife roller at the discharge end of said throat and in spaced parallelism with the cutting-block roller to provide a space between said rollers for receiving the web as it is discharged from the throat, a gang of

knives rotatively fixed upon the knife roller and having circular cutting edges circumscribing such roller and spaced apart axially thereof, said knives being sufficiently large in diameter to bridge the space between said rollers for placing their cutting edges in complemental cutting relation with the periphery of the cutting-block roller, and means for rotating the knife roller oppositely to the cutting-block roller whereby said roller and the knives thereon cooperate with the cutting-block roller in cutting the web into strips and in advancing the material through said space between these rollers, and means for dicing said strips comprising stripping means projecting toward said space from the discharge side thereof and between said knives to deflect the strips for causing their endwise movement from said space independently of the knives, a cutter blade in close proximity to said stripping means and arranged in contiguity to and crosswise of the path of the endwise-moving strips, and a cutter movable across said path toward and into complemental cutting relation with said blade to clip dice-like sections from the endwise-moving strips.

WILLIAM E. URSCHEL.
JOE R. URSCHEL.