

April 1, 1941.

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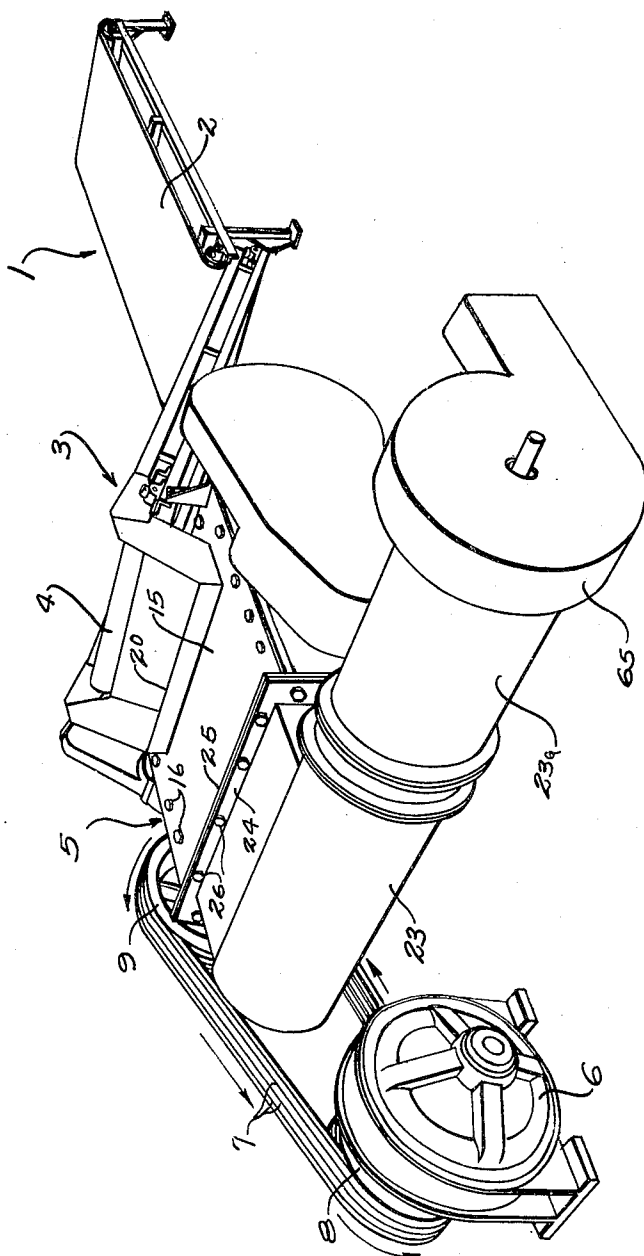
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PAPER SHREDDER

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3 Sheets-Sheet 1

Fig 1



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Fig 3

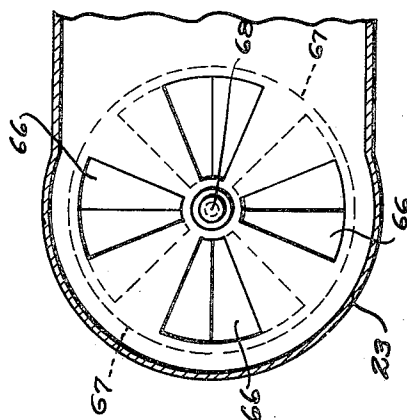
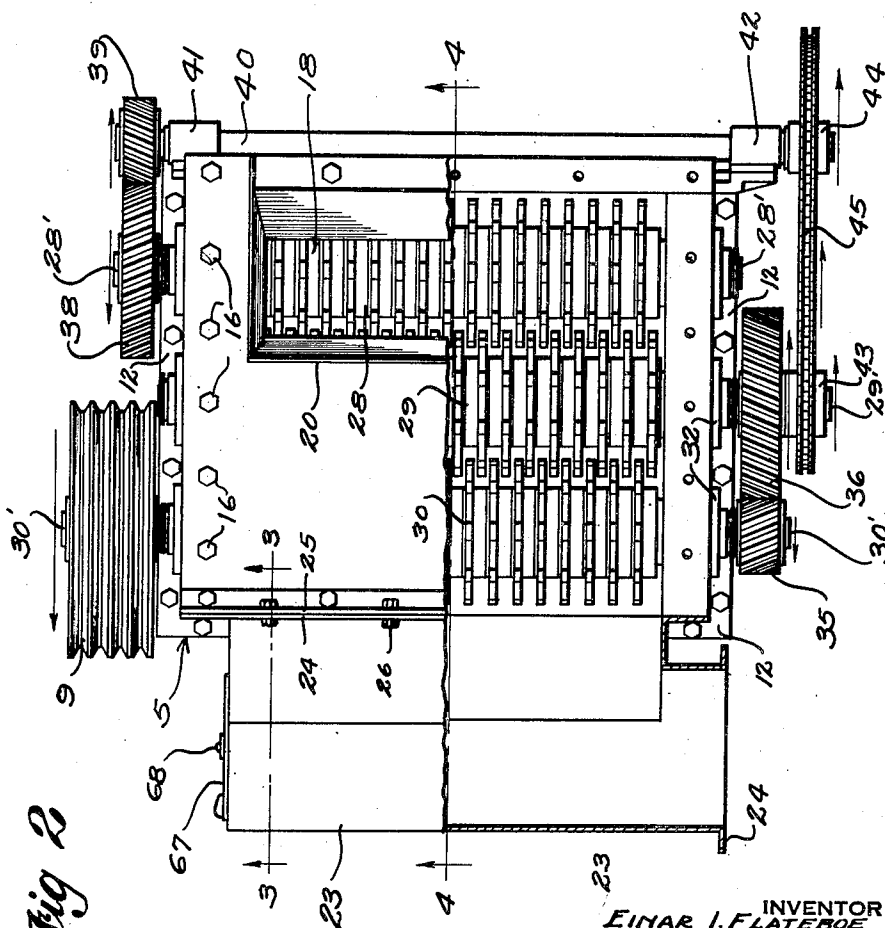


Fig 2



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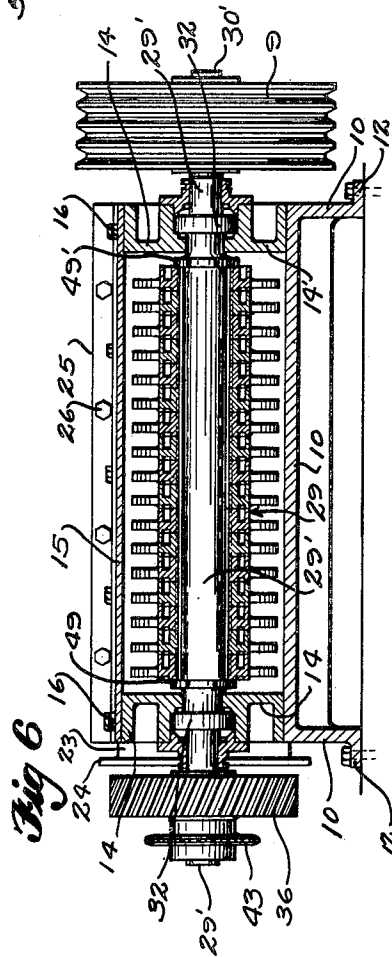
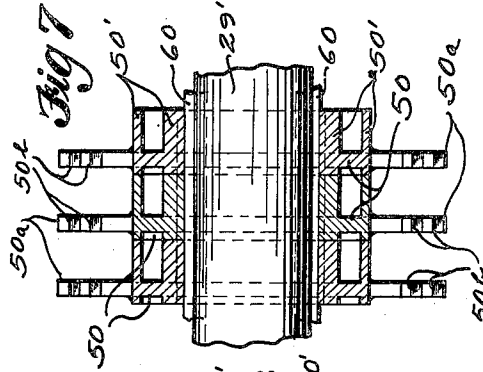
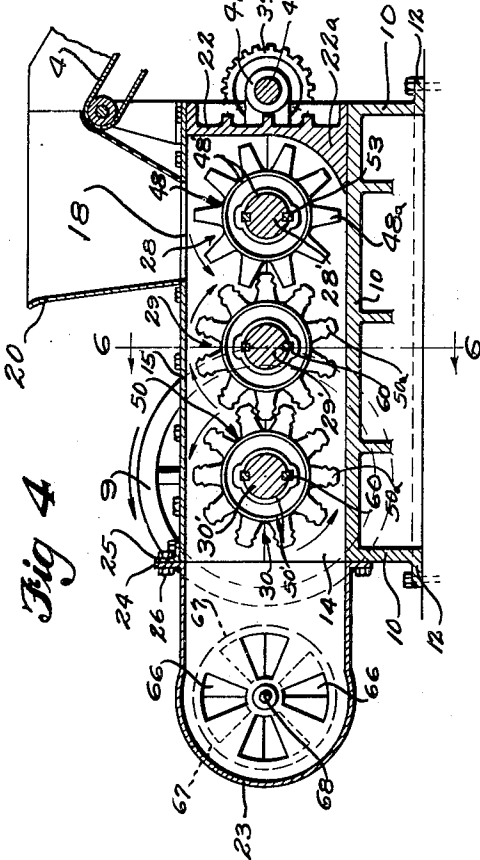
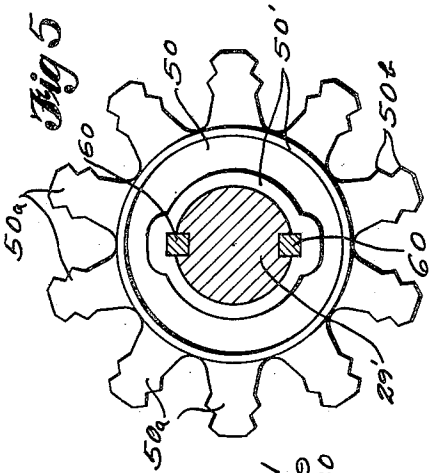
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3 Sheets-Sheet 3



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PAPER SHREDDER

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Application September 6, 1938, Serial No. 228,599

4 Claims. (Cl. 83—6)

This invention relates to shredders, and has reference more particularly to machines designed for the tearing up, shredding, or reducing of paper magazines, catalogs, periodicals, news papers, and the like, as a means of converting the same into separated pieces of paper of sizes that permits them to be properly acted on in a treatment for reconversion into pulp, from which paper, cardboard, and the like of certain grades may be made.

Explanatory to the present invention, it will here be stated that there are innumerable articles, such as telephone directories, catalogs, magazines and similar paper books, discarded daily that are made of a grade of paper that is of suitable character to be reconverted into pulp of a kind suitable for the manufacture of certain grades of cardboard and paper that have wide range of uses. However, in order to make the reconversion of these paper articles into pulp, it is necessary that the work of reducing, disintegrating, or tearing them up be expeditiously and economically done and that the pieces of paper be torn, separated and crumpled, so as to be in proper condition to receive the following treatments.

In view of the above, it has been the principal object of the present invention to provide a substantial, power driven paper shredder, of large capacity and operable to satisfactorily break up a book, catalog, directory, magazine or folded news papers, and to tear up, separate and crumple the pieces of paper, and deliver them for the treatments which are to follow in the reconversion of this paper into pulp.

More specifically stated, the objects of the invention reside in the provision of a machine as above noted comprising a receiving hopper, into which the articles to be shredded are first received, and a series of toothed shredding rolls into which the articles are delivered from the hopper; the rolls being arranged to successively or progressively receive the paper and so constructed and spaced in such relation that the projecting teeth of one roll rotate in the space between the teeth of the adjacent roll, to a limited extent without touching. These rolls are to be driven at different speeds thereby to effect a tearing and disintegrating action by the teeth that leaves the paper in the necessary shredded and crumpled condition.

It is also an object of this invention to provide for removal of the crumpled and torn pieces of paper from the machine by suction.

Other objects of the invention reside in the

construction of the shredding rolls, in their relationship and relative driven speeds whereby the breaking down of the articles is progressively accomplished.

Still further objects of the invention reside in the details of construction of the various parts of the machine, in their mode of operation and manner of use as will hereinafter be fully described.

In accomplishing the above and other objects of the invention, we have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a perspective view of an apparatus including therein a paper shredding machine made in accordance with the present invention.

Fig. 2 is a plan view of the shredding machine showing a part of the top plate and a part of the suction tube removed for the purpose of better illustrating parts inside the machine.

Fig. 3 is a longitudinal sectional view of the shredder as seen in the line 3—3 in Fig. 2.

Fig. 4 is a vertical longitudinal cross section as seen on the line 4—4 in Fig. 3.

Fig. 5 is an enlarged detail view of one of the shredding teeth, as would be seen on the line 4—4 in Fig. 3.

Fig. 6 is a vertical transverse cross section as seen on the line 6—6 in Fig. 4.

Fig. 7 is an enlarged detail view of the shredding teeth as would be seen on the line 6—6 in Fig. 4.

Referring more in detail to the drawings—

The present apparatus, considered as a unit and as illustrated in Fig. 1, comprises a table or platform 1 across which a driven conveyor belt 2 operates to deliver the books, magazines, catalogs or other articles that are to be shredded, onto an elevator 3. The elevator includes a traveling belt 4 whereby the articles received for the belt 2 are delivered into the shredding machine which, in Fig. 1, is designated in its entirety by reference numeral 5. The shredder in this particular instance is illustrated as being driven by an electric motor 6 that is operatively connected thereto by means of a plurality of V belts 7 which operate about the motor pulley 8 and the driving pulley 9 of the shredding machine.

Since the conveyor mechanism, the elevator, and the electric motor form no particular part of the present invention, these parts will not be described in any further detail.

Referring now more particularly to following figures, the shredding machine, in a preferred

form of construction, comprises a heavy metal housing 5 of rectangular form, having an inlet for the reception of the various articles to be broken down and torn apart and an outlet for discharge of the crumpled pieces. Inside this housing there is arranged a series of parallel, revolvably driven toothed rolls, so constructed and spaced that the projecting teeth of one roll rotate in the space between the teeth of the adjacent roll to a limited extent without touching. These rolls, from the inlet end of the housing toward the outlet are driven at progressively increased speeds so that, while moving in the indicated direction, there will be a desired tearing action by coacting rolls. This progressive action eliminates any concentrated strain and also overcomes any tendency to clog the machine at the first roll. The torn and crumpled paper is received from the discharge or outlet into a suction housing and this is damper controlled so that the degree of suction may be varied.

In this preferred construction, the housing of the shredder comprises a heavy, horizontal base section 10 of rectangular form, provided with a peripheral flange 12 for reception of anchor bolts. Fixed upon this base 10, along the opposite side edges, are the side wall sections 14—14' of corresponding length and height, and to these is secured a flat, top plate 15; the plate being fixed in place by a plurality of bolts 16 that are extended through and bolted to the top edges of the side wall section 14—14'.

It is to be observed that the top plate 15 is provided, at the receiving end of the machine, with a transverse, rectangular opening 18 about which a hopper 20 is fixed. This hopper is disposed in position to receive the articles from the elevator conveyor belt 4 and to discharge them into the machine through the hopper 20 and the opening 18. At its receiving end, the housing is closed by an end wall section 22, which is arcuately curved inwardly, as seen at 22a in Fig. 4. At its other end, that being the discharge end, the housing is open and in direct communication with a suction housing designated in its entirety by reference numeral 23.

It will be observed that the suction housing is somewhat of tubular form and is flanged, as at 24 to fit or register with the end flanges 25 of the main housing to receive the attachment bolts as designated at 26. The tubular housing extends transversely of the end of the machine for connection at one end with a suction fan or the like as presently described.

Mounted inside the shredder housing are the shredding rolls; these being three in number in this instance and designated respectively by numerals 28, 29 and 30. These rolls are disposed in the same horizontal plane and in parallel relationship and have their axles, or supporting shafts, 28', 29' and 30', revolvably contained in bearings 32 provided therefor in the side walls 14 of the housing, as will be understood by reference to Figs. 2 and 6.

Referring now more particularly to Figs. 2, 4 and 6 of the drawings, it is to be observed that the motor driven belt pulley wheel 9 is fixed, outside the housing 5, to one end of the driving and supporting shaft 30' for the roll 30; this being the roll nearest the discharge end of the machine and incidentally the fastest driven roll. At the other end of this roll, a gear wheel 35 is fixed on the shaft 30' in driving mesh with a gear 36 on the driving shaft 29' of the adjacent roll

29, that is the central roll. The gear wheel 35 is somewhat less than half the diameter of the driven gear 36 and thus the roll 29 will rotate at a proportionate slower rate of speed.

Roll 28, which is located at the entrance end of the housing, has its driving shaft 28' equipped at one end with a driving gear wheel 38 that is in mesh with a smaller driving gear wheel 39 carried on one end of a cross shaft 40. Shaft 40, as noted in Fig. 2, is disposed across the receiving end of the machine, outside of the end wall, and is revolvably contained in mounting bearings 41 and 42, which are suitably fixed to the end wall 22. On the end of shaft 40, opposite that end which carries gear wheel 39, a sprocket wheel 44 is fixed in alignment with a relatively smaller sprocket wheel 43 fixed on the end of shaft 29' just outside the gear 36. A sprocket chain belt 45 operates about the sprocket wheels 43 and 44 to provide a driving connection through which the roll 28 will be driven. The gear ratios, in this connection, are such that roll 28 is driven at a slower speed than the others. It will here be mentioned that, with the parts as here shown, the rolls, from the receiving toward the discharge end of the machine will rotate at rates corresponding to the proportion of 60, 240 and 600 revolutions per minute; this being a satisfactory condition in this machine.

Going somewhat more into detail with reference to the housing, it is to be observed by reference to Fig. 4, that the inner surface of the front end wall 22 is arcuately curved inwardly, as at 22a to maintain a close relation to the periphery of the adjacent roll 28 and to prevent the piling up and clogging of material in what otherwise would be a square corner recess.

The roll 28 is made up of its central, or axial shaft and a plurality of tooth frames 48 concentrically mounted thereon and extending the full width of the housing. These frames are clamped tightly together in close functional relationship, by nuts 49—49' threaded and locked on opposite end portions of the shaft just within the side walls.

Each of the frames 48 comprises a central hub portion 48' that is fitted on the roll mounting shaft and from which hub a plurality of teeth 48a extend. These teeth are equally spaced apart and extend radially of the hubs, also, the teeth of the series of frames on the roll 28, are all aligned lengthwise of the roll and preferably have smooth or straight cut side edges. It will be noted by reference to Figs. 2, 6 and 7 that the teeth are of lesser thickness in the axial direction of the hub of their mounting frame than the length of the hub portions; thus the teeth of each row in lengthwise direction of the roll are spaced apart, as noted in Figs. 2 and 6. The frames also are fixed against rotation on the shaft by keys 53 and therefore the teeth maintain their alignment both circumferentially and longitudinally of the roll.

With reference to the rolls 29 and 30, each of these likewise is composed of its mounting shaft and a series of frames 50 clamped together in tight relation thereon and held between clamping nuts 49—49' threaded and locked on the end portion of the shaft. The frames also are held against rotation by keys 60 seated in key slots in the shafts and hub portions of the frames. Each frame 50 has a hub portion 50' and, as in the other roll described, is equipped with a plurality of equally spaced radial teeth 50a. The teeth of these rolls, however, preferably are serrated

or notched along the side edges, as at 50b to give a better tearing action on the paper. The frames on the shafts of rolls 29 and 30 are adjusted so that the teeth of alternate frames are alined, and thus, the teeth of successive frames are staggered. In the setting of the three rolls, the adjustment is such that the teeth of the central roll are adapted to pass between the circumferential rows of teeth of the first and last roll, as will be understood best by reference to the plan view of Fig. 2.

Material that is discharged after passing the roll 30 is received directly into the suction housing 23. This comprises a cylindrical or tubular body portion extending transversely of the discharge end of the housing and to one side thereof. Along one side this tube has open communication with the housing 5 and at one end it has a tubular connection 23a with the housing 65 of a suction fan whereby the torn and crumpled pieces of paper will be drawn out of the tube by suction and delivered to a point of storage. At the other end, the housing 23 has openings 66 over which a damper disk 67 is mounted for adjustment on a pivot bolt 68 to regulate the effective size of the openings to admit more or less air, as is necessary to produce the most efficient operation of the suction fan for removal of the small pieces of paper.

Assuming now that the machine is constructed as illustrated and described, its operation will be as follows:

By starting the motor 6, the V belts 7, which are disposed around the belt pulleys 8 and 9, will be driven in the direction of the arrows adjacent thereto in Fig. 1, which is a counter-clockwise direction. It is evident that with the shaft 30' rotating in this direction that the shaft 29' will rotate in a clockwise direction through the gears 35-36 mounted on these respective shafts and in operative mesh with each other. The shaft 28' will be driven in a counter-clockwise direction, since the shaft 40 is driven in a clockwise direction by the chain belt 45, which is disposed about the sprockets 42 and 43, and the gear 38 which is mounted on the shaft 28' is in operative mesh with the gear 39 on the shaft 40. The direction of rotation of the frames 28, 29 and 30 are indicated by arrows adjacent thereto.

With the shredder in operation as just explained, the books, magazines, catalogs, papers, etc. to be shredded will be placed on the conveyor belt 2 of the table or platform 1.

As this conveyor belt 2 moves along the material is carried by the conveyor belt 4 in the elevator 3, and dumped into the hopper 20. In the present instance a chain belt and sprocket drive are provided between the shaft 28' and the upper roller of the conveyor belt 4. Likewise a chain belt and sprocket connection is provided between the lower roller of the conveyor belt 4 and the forward roller of the conveyor belt 3. These connections are not illustrated, as it is to be understood that any means may be employed to power these conveyor belts. These structures are old in the art and a more specific description is not considered necessary.

It is to be understood that in the use of such a shredder the materials are placed on the conveyor belt 2 in such a way as not to place a heavy load on the machine suddenly, but to distribute the load evenly by varying or staggering the loading of the conveyor belt 2.

With the rolls 28 and 29 rotating towards each

other, as previously described, the material which is dumped thereon through the hopper 20 will be torn apart by the rotation of the staggered, over-lapping teeth 48' and 50'. It is obvious that with the roll 28 rotating faster than the roll 29, there will be a tearing action exerted on the material falling there between.

The serrations or notches 50b on the teeth 50a of the roller 29 have a tendency to grip the paper of the materials, and tear it, and carry it forward to the next roll, where it undergoes a similar operation by the roller 30, which is rotating at a still much higher rate of speed.

It is obvious that with such a combination of rotating rolls provided with teeth extending therefrom in staggered and over-lying relation, that the paper will be thoroughly torn up or shredded as it is carried back and forth from roller to roller, and finally discharged from the machine.

It may well be stated here that the paper is thoroughly torn apart, into small pieces, and also thoroughly crumpled. This is particularly advantageous and to be desired in the manufacture of paper, as stated, in that none of the paper fibres have been cut, but that they have been pulled apart in the tearing or shredding operations. This contributes to the strength and binding properties of the finished paper made from this material.

Furthermore, it makes the interior of the paper more accessible to the water and other chemical reagents used, in that it presents a fibrous end or edge to the water and solutions used, which will absorb water and solutions and carry it into the interior of the pieces of paper. Also as the paper is crumpled in the operation of the machine, the hard surface of the paper is also broken up, which causes the fibres of the paper to be ruffed up and consequently opened up to the water and solutions also.

Such advantages, as above mentioned, are evident to those familiar with the art, and the utilities and applications are readily apparent.

It is obvious that this invention is capable of numerous forms and variations without departing from the essential features herein disclosed.

Having thus described my invention, what I claim as new and novel therein, and wish to secure by Letters Patent, follows:

1. A machine of the character described, comprising a housing forming a continuous passage having receiving and discharge openings at opposite ends, means for feeding material into the machine through the receiving opening, a suction tube connected with the discharge opening for withdrawal of shredded material by suction through the passage, a succession of parallel shredding rolls rotatably mounted on axes extending transversely of the path of material within the housing between the receiving and discharge openings, and means for rotating said rolls at speeds progressively increased from the receiving to the discharge opening; each of said rolls having rows of teeth thereon arranged to overlap with clearance the rows of teeth of adjacent rolls, for cooperatively acting on the material for its disintegration and advancement along the passage.

2. A machine of the character described comprising a housing forming a continuous passage having receiving and discharge openings at its opposite ends, a hopper arranged for the feeding of articles into the machine through the

receiving opening, a suction device connected with the discharge opening for the withdrawal of shredded material by suction through the passage, a plurality of horizontally disposed, parallel shredding rolls of like diameter mounted on axes extending transversely of the housing within the housing between the receiving and discharge openings for the shredding and advancement of material through the machine; each roll having radially extending teeth arranged in spaced rows circumferentially thereof and overlapping, with clearance, the rows of teeth of adjacent rolls, and means for driving the rolls in such direction that the overlapping teeth of adjacent rolls will move in the same direction at different speeds whereby to effect the destruction of articles received between the rolls coincident with its advancement along the passage.

3. A machine as recited in claim 2 wherein the suction device comprises a housing applied to the machine housing in open communication with its discharge opening, and a suction fan is applied to one end thereof; said housing having an opening in the end opposite the suction fan, and a damper applied to the said opening and adjustable to regulate the degree of suction

applied through the passage for the withdrawal of shredded material.

4. A machine of the character described, comprising a housing forming a continuous passage provided with a top opening at one end and open at its opposite end for discharge of material, a hopper for the delivery of material to the passage through the receiving opening, a suction housing applied to the machine housing in open communication with the discharge opening, a suction device applied to said suction housing, a plurality of horizontal, parallel shredding rolls mounted on axes extending transversely of and within the machine housing between the receiving and discharge openings, means for rotating the rolls at speeds progressively increased from the receiving to the discharge end of the machine, and in such direction that adjacent sides of the rolls move in the same direction for disintegration of the material and its advancement along the passage; each of said rolls having teeth extending therefrom in rows lengthwise and circumferentially thereof and overlapping, with clearance, the teeth of adjacent rolls, and means for regulating the application of suction.

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