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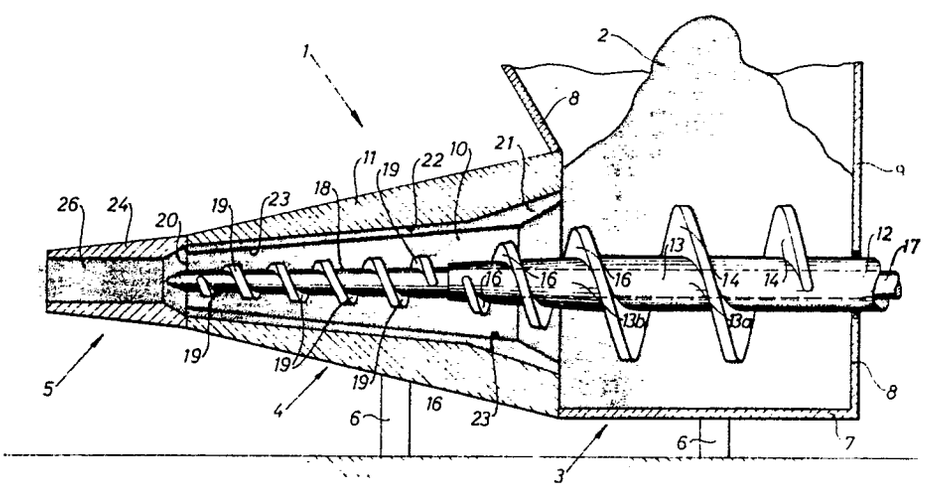
(54) A machine for the compression of a bulky mass.

(57) A machine for the compression of a bulky mass (2), e.g. plastic-coated, shredded waste paper, so as to form a compact, elongated, well-integrated body, e.g. a fuel body for heating purposes. The machine has a driven screw arrangement arranged centrally in a conically tapering space (10) which comprises on the one hand a rear feed screw (13), partly located in the said space, and on the hand a front compression screw (18), arranged concentrically in relation to the feed screw, both the said screws being rotatable at mutually unequal speeds.



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A MACHINE FOR THE COMPRESSION OF A BULKY MASS

The present invention relates to a machine for the compression of a bulky mass, so as to form an elongated, densely-packed body, this machine having a space conically tapering towards an outlet opening and a driven screw arrangement arranged centrally in the space.

Every year several thousands of tons of combustible industrial waste are produced whose only extractable economic value rests in the possibility of utilizing as large a part as possible of its latent energy content by means of combustion, for example, for heating purposes. In order to make such a recovery of energyat all possible it is necessary many times though to subject the waste to some type of processing which means in principle that, after sorting out the inferior material, the remaining, more combustion-effective material is converted to a final form suitable for combustion, e.g. so-called fuel briquettes. This conversion of form or compression usually takes place with the help of a machine of the type which has been described above and which thus consists of a rotating screw located centrally in a conically tapering machine space, with the help of which the refuse is pressed in form of a helical line through the space, with successive compression, so as to form an elongated, well-integrated and form-stable fuel body which subsequently is cut up to the final briquette shape.

The known machine described here functions well in association with waste of a more or less easily sliding character, rarely or never, on the other hand, with dry bulky refuse masses of the type of waste paper, especially plastic-coated waste paper of the type which occurs in the manufacture of packing laminate for so-called non-returnable packages for fluid contents. The only possibility of converting such dry paper waste to effective form-stable fuel briquettes with the help of the known machine of the screw type has been, therefore, either to eke outthe paper with waste material of the more easily sliding kind and/or to add water in order to wet and thereby soften up the paper and transform it into a more appropriate and easily processable consistency. Such necessary measures involved, however, a worsened heat economy, owing to the additional blending material as a rule being less combustion-effective than the "pure" waste paper, whilst any transformation of consistency with the help of water usually required a subsequent energy-consuming heat treatment in order to dry the moist fuel body formed.

It is an object of the present invention, therefore, to provide a machine of the type as described above, but which in contrast to the known machine permits an effective compression of combustible, bulky refuse, especially plastic-coated waste paper, without the previously necessary energy-impairing pretreatment of the refuse material.

This object is achieved in accordance with the present invention in that the machine described in the introduction has been given the characteristics specified in the claims.

The invention will be explained and described in more detail in the following with reference to the attached drawing which schematically shows a very simple, but practical and well-functioning embodiment of the machine in accordance with the invention for the manufacture of form-stable fuel bodies from combustible, bulky refuse material, especially plastic-coated waste paper.

On the drawing is thus shown a machine, which has been given the general reference designation 1, in accordance with the present invention for the compression of a bulky mass of combustible, dry refuse material 2 which in the example described here is assumed to be plastic-coated waste paper. The machine 1 comprises mainly three machine sections, namely a feed-in section 3, an active working section 4 and a feed-out section 5, which are joined together to a machine unit which may be supported on a stand 6. The feed-in section 3 of the machine 1 comprises a box 9 open at the top which is limited by a horizontal bottom wall 7 and substantially vertical side walls 8 to receive and collect waste paper 2 supplied from above which is to be compressed. The box 9 is connected through a hole provided in the front (lefthand) side wall 8 of the box with a conically tapering compression space 10 in a housing body 11 of the active machine section 4 arranged against this side wall. In the rear (righthand) side wall 8 of the box 9 a corresponding hole is provided for a hollow driving shaft 12 supported in the hole in a rotatable manner for a feed screw 13 located in the lower part of the box, which has a rear screw section 13a located wholly in the box 9 with screw threads 14 of mutually equal pitch, and a front screw section 13b extending at least partly into the conically tapering space 10 comprising screw threads 16 with a pitch successively diminishing towards the space 10. Centrally inside the hollow of the driving shaft 12 is supported in freely rotatable manner a driving shaft 17 for a compression screw 18 arranged wholly inside the said space 10 in a straight line in front of the feed screw 13, with screw threads 19 whose pitch decreases

successively towards the outlet opening 20 of the space 10. The driving shafts 12 and 17 can be driven in a manner known in itself with the help of a suitable gear drive arrangement by means of one and the same motor (not shown), and in accordance with the invention it is important here that the transmission of power between the motor and the shafts 12 and 17 is adapted so that they can be driven at speeds of rotation freely adjustable in relation to each other. Preferably the shaft 17 for the compression screw 18 is adapted to be driven at twice the number of revolutions as the shaft 12 for the feed screw 13.

With the object of facilitating the feed-in of the bulky waste paper 2 into the compression space 10, this space has a feed-in region 21 facing towards the box 9 with a somewhat larger taper than the front zone of the space 10, diminishing conically towards a more acute top angle. Furthermore the space 10 preferably has surface irregularities promoting the feed of the waste paper 2 in the form, for example, of parallel,longitudinal grooves or ridges 23 spaced uniformly around the inner wall 22 of the housing body 11 delimiting the space.

The feed-out section 5 of the machine 1 finally comprises a hollow, mainly cylindrically shaped housing body 24 arranged against the housing body 11 and located so that the axial, cylin drical cavity 26 of the housing body 24 constitutes a direct continuation of the outlet opening 20 of the conical space 10.

The machine 1 in accordance with the present invention described above operates in the following manner. With the help of the said motor (which may be a conventional electric motor of 55 kW with a motor speed of 1470 rpm) the shafts 12 and 17 are driven via a suitable power transmission arrangement (e.g. a gear drive of known type) so, that the compression screw 18 is rotated at a speed (e.g. 882 rpm) which is approx. twice as high or even higher still than the corresponding speed (e.g. 411 rpm) for the feed screw 13. The bulky paper refuse 2 supplied from the top and collected in the box 9, which in the present example consists of shredded, or in a similar manner homogenized, plastic-coated waste paper consequently will be picked up and advanced in form of a helical line into the space between screw threads 14 of the screw 13 towards, and into, the conical space 10 through the open, wider end of the feed-in zone 21. Owing to the fact that the free space between the feed screw 13 and the inner wall of the housing body 11 successively diminishes in the direction in towards the space 10, because of the conical tapering of the feed-in zone 21,the bulky mass of paper waste thus fed will be subjected to a certain precompression during the passage through the feed-in zone 21. This precompression, which mainly implies a squeezing out of entrained air, is compensated slightly, though, in that the shaft as well as the pitch of the screw threads 21 of the front screw section 13b located partly within the feed-in zone 21 taper or decrease respectively in the direction of feed of the feed screw 13.

The paper waste thus advanced and precompressed by the feed screw 13 through the feed-in zone 21 is advanced further through the space 10, with the help of the compression screw 18 arranged in front of the feed screw 13 and wholly in the conical space 10, into the cylindrical feed-out cavity 26 of the housing body 24 through the outlet opening 20.

Since the quantity of paper which is advanced through the feed-in zone 21 by the feed screw 13 is greater than the quantity which actually should be received by, and be advanced through,. the space 10, which successively tapers towards the outlet opening 20, this means consequently that a certain piling up of paper waste fed must occur in the feed-in zone 21. However, in accordance with the invention this phenomenon is avoided by virtue of the compression screw 18 being rotated at a higher speed than the feed screw 13, more particularly at such a speed that the quantity which is advanced per unit of time by the feed screw 13 exactly matches the quantity per unit of time which the compression screw 18 at the higher speed is capable of advancing into the free space between the threads 19 and the inner surface of the housing body 11. This free space decreases, however, successively towards the outlet opening 20 and during the advance with the help of the compression screw 18 heat will be generated owing to inner friction in the paper waste thus advanced. The frictional heat generated is sufficiently strong for the plastic coating (e.g. polyethylene) on the paper bits to melt and thereby effect a fusing together of adjoining paper bits, so as to form an elongated, compressed and, with the help of the paper bits so fused together, form-stable fuel body which is fed out continuously through the cavity 26 in the housing body 24.

Claims

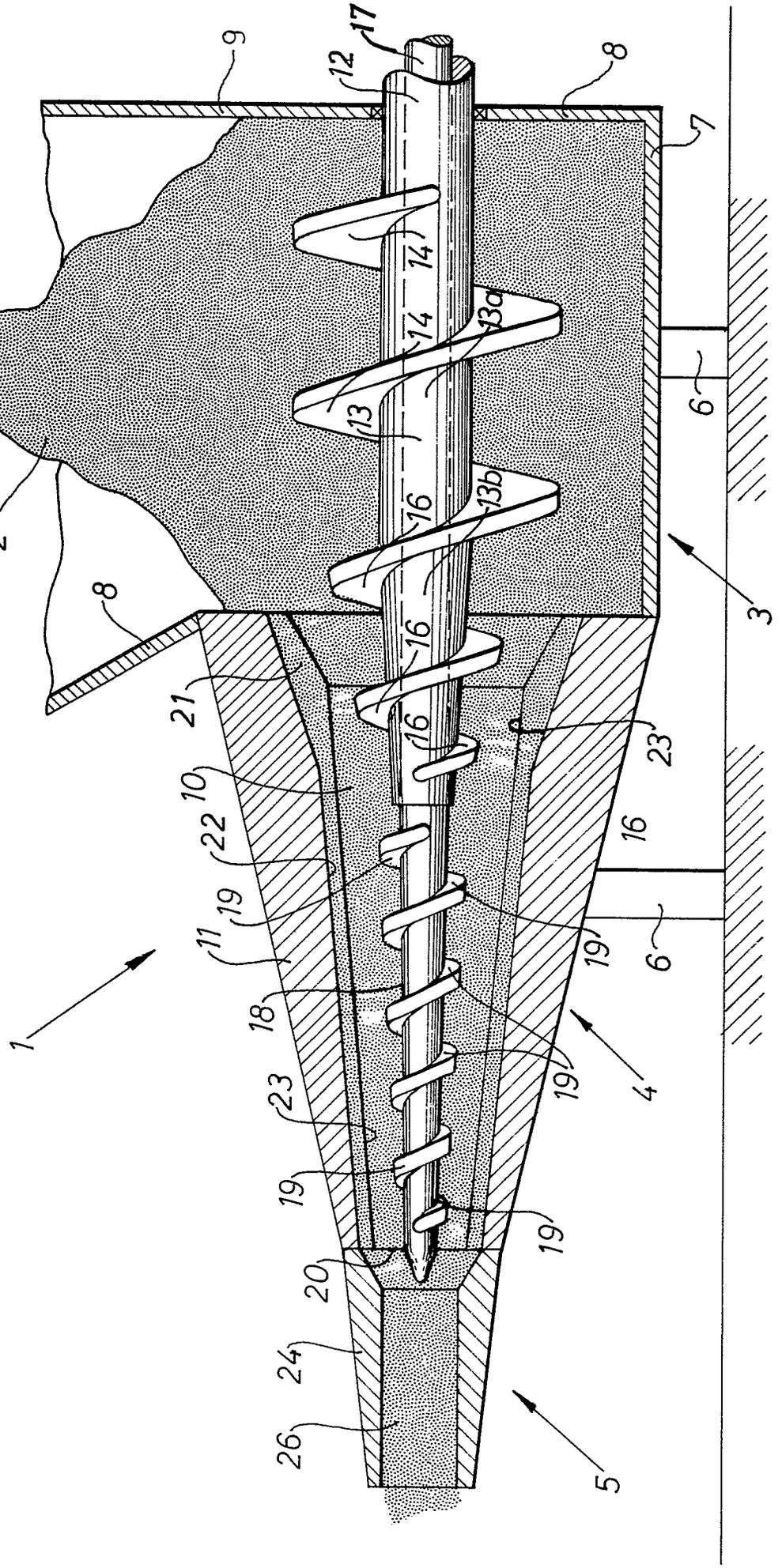
1. A machine for the compression of a bulky mass, so as to form am elongated, densely packed body, this machine having a space (10) conically tapering towards an outlet opening (20) and a driven screw arrangement arranged centrally in the space (10), **characterised in** that the screw arrangement comprises a rear feed screw (13) with screw threads (16) and a front compression screw (18) with screw threads (19), that the respective screw threads (16 and 19) have pitches decreasing

towards the outlet opening (20), and that the two screws (13 and 18) are rotatable at mutually unequal speeds of rotation.

2. A machine in accordance with claim 1, **characterized in** that the respective speeds of rotation of the screws (13 and 18) are freely adjustable.

3. A machine in accordance with claim 1 or 2, **characterized in** that the feed screw (13) has on the one hand a rear cylindrical screw section (13a) located outside the conically tapering space (10) and on the other hand a conically tapering screw front section (13b) located wholly within this space.

4. A machine in accordance with anyone of the preceding claims, **characterized in** that the front end of the conically tapering space (10) is connected directly to a cylindrical outlet duct (26)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European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 87103819.6

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE - A1 - 3 429 848 (ANDREAS KOFFERATH) * Fig. 2 * --	1,2,4	B 30 B 11/24 B 29 C 47/50
Y	DE - A1 - 2 736 810 (REINHALL) * Page 4, line 33 - page 5, line 4; fig. 1 * --	1,2,4	
Y	CH - A - 388 616 (REIFENHÄUSER) * Fig. 2 * --	1,2,4	
A	SOVIET INVENTIONS ILLUSTRATED, section PQ, week E33, September 29, 1982 DERWENT PUBLICATIONS LTD., London, P 71 * SU-872 295 (AS BELO CONS BUR)* --	1,2	TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 28 B
A	DE - B - 1 009 799 (FÜHRER) * Fig.; column 2, lines 31-36 * --	1,2	B 29 C B 30 B
A	GB - A - 1 020 442 (THE ENGLISH) * Fig. * ----	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	10-07-1987	GLAUNACH

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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