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WEAR PLATE ASSEMBLY FOR JAW CRUSHER

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2 Sheets-Sheet 1

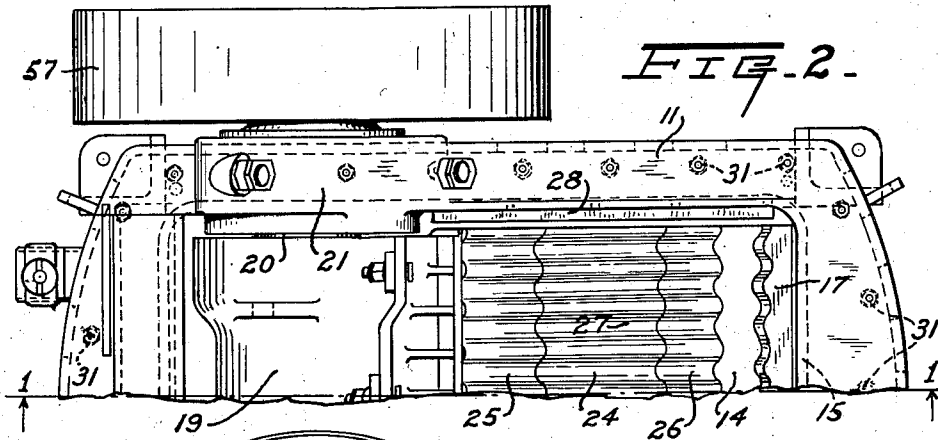


FIG. 2.

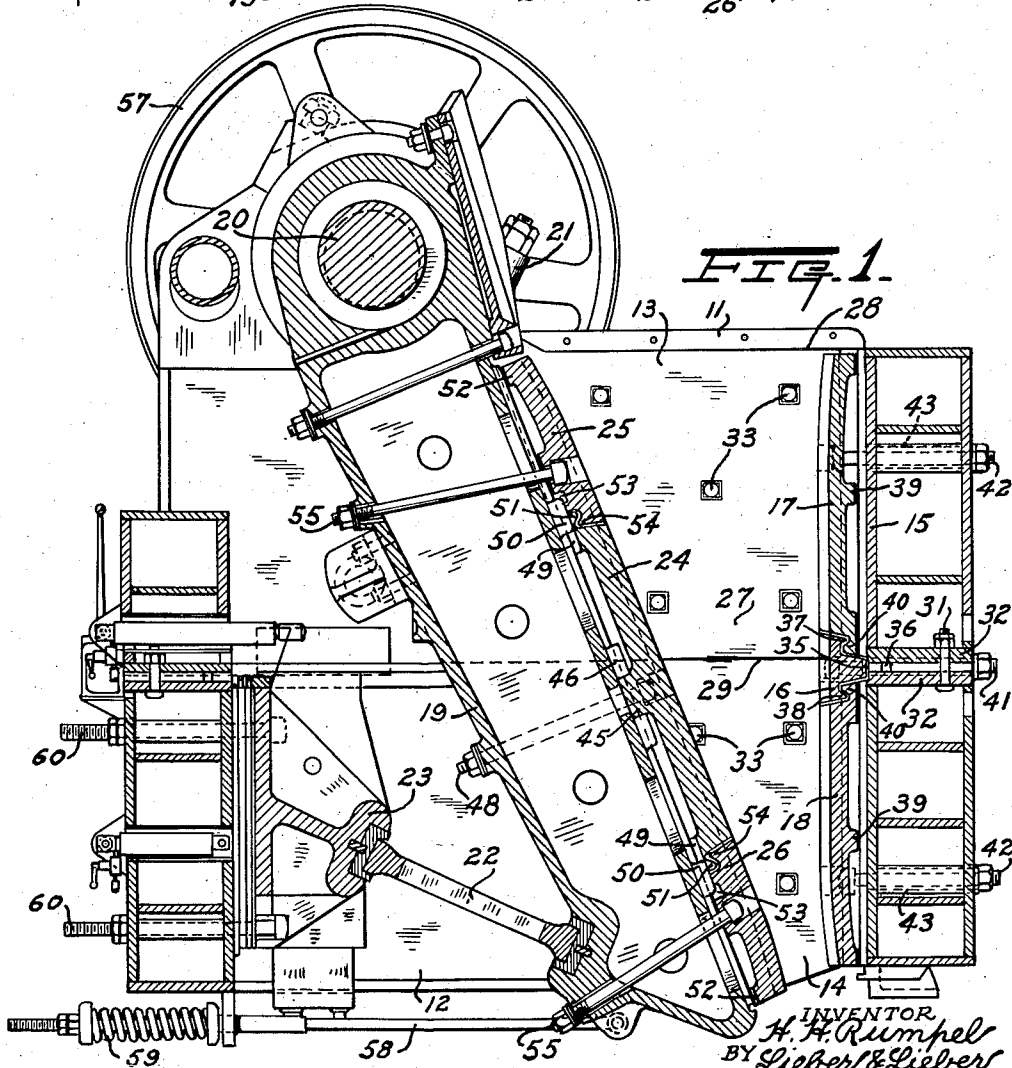


FIG. 1.

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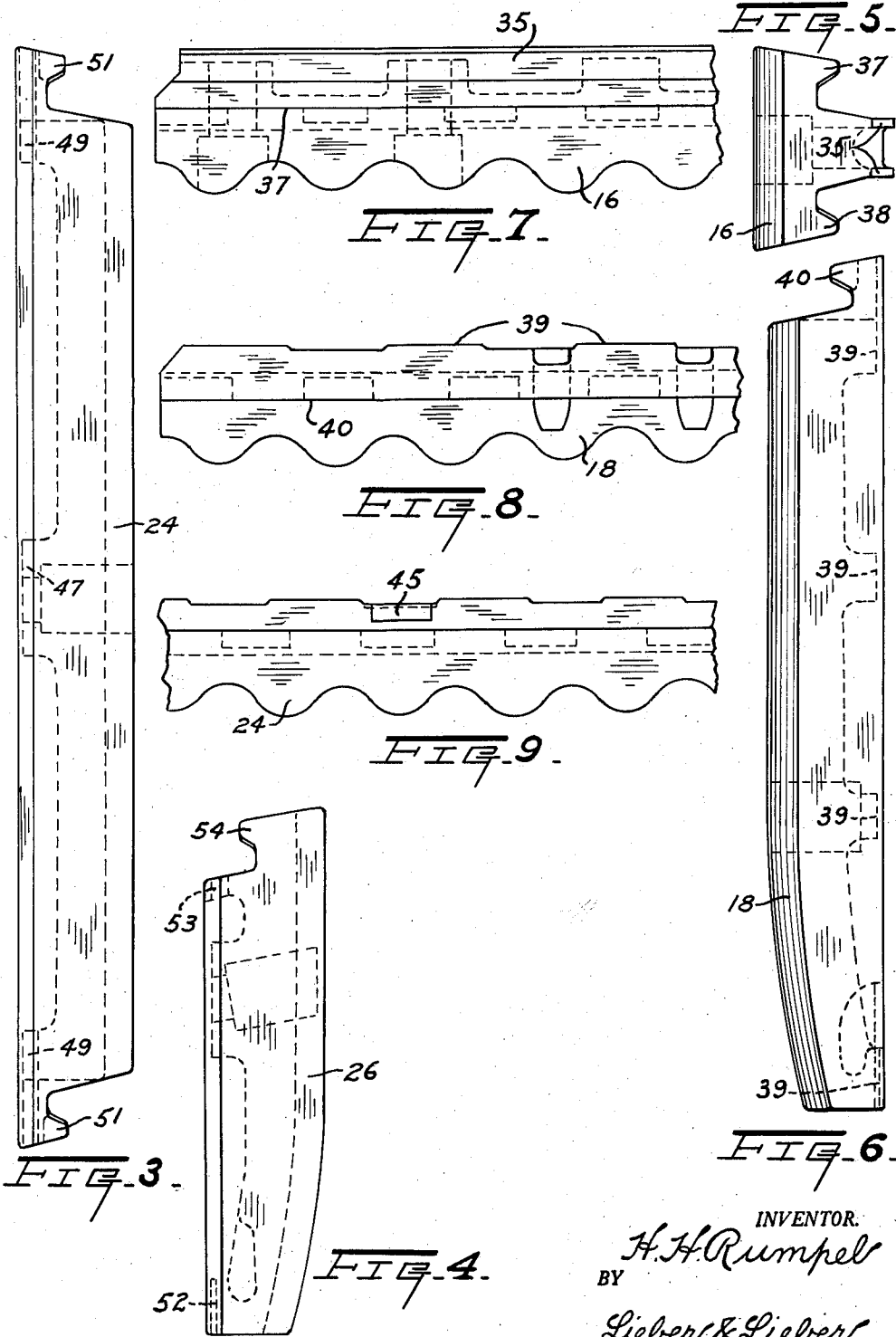
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WEAR PLATE ASSEMBLY FOR JAW CRUSHER

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8 Claims. (Cl. 241—267)

The present invention relates generally to improvements in crushers for rock, ore and similar hard and abrasive substances, and relates more specifically to improvements in the construction of jaw type crushers or the like.

The primary object of this invention is to provide a rock and ore crusher wherein the crushing elements are most effectively protected against undesirable distortion tending to reduce their effectiveness, and in which the parts subjected to maximum wear are readily replaceable.

Crushers for hard and relatively abrasive substances such as rock and ore, ordinarily have their surfaces which are directly exposed to the crushing action, protected against rapid wear by so-called liners or dies formed of wear resistant material such as manganese steel. While such material is capable of effectively resisting abrasive action, it is quite malleable and stretches when subjected to repeated impact and peening for any great length of time. In relatively small crushers wherein the directly exposed crushing surfaces are not extensive they are confined between stops at their upper and lower edges, but such slight stretching of the liners or dies does not materially affect the crushing action and all that is required is replacement of the liners when excessively worn.

However, in large crushers of the jaw type having extensive protective liners or dies, the stretching or elongation of these elements causes them to swell and bulge away from their supports if confined by stops at their opposite edges. When such bulging occurs, the liners are alternately pressed inwardly and expand outwardly at the bulges as the crushing members approach and recede from each other, thus not only reducing the effectiveness of the crushing action and wasting power, but also tending to cause breakage of the dies due to repeated bending. Then too, in such jaw crushers, the maximum wear usually takes place near the inlet and outlet of the crushing chamber, so that if the liner of each crushing member is formed of a single piece of manganese, replacement of an entire liner often entails considerable unnecessary expense due to waste of still usable liner or die stock.

It is therefore a more specific object of the present invention to provide an improved protective liner or die assemblage especially adapted for use in large jaw type crushers, and which obviates all of the above mentioned objectionable features.

Another important object of this invention is to provide an improved mounting for the protecting liners of cooperating relatively movable crushing members, whereby objectionable bulging or other distortion of such liners is effectively eliminated.

A further important object of the invention is to provide an improved protective die assemblage for jaw crushers or the like, which most effectively compensates for spreading of the dies due to impact and peening action to which they are subjected.

Still another important object of this invention is to provide improved protective liners for the cooperating

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crushing jaws of large jaw crushers, wherein either the entire liners or only selected excessively worn portions thereof may be conveniently renewed.

An additional important object of the invention is to provide an improved jaw crusher of enormous capacity and of great strength and durability which can be effectively operated with minimum loss of time due to necessary repairs.

These and other more specific objects and advantages of the present invention will be apparent from the following detailed description.

A clear conception of the several features constituting the present improvements and of the construction and operation of a typical jaw crusher embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a central vertical section through a jaw crusher equipped with the improved liner dies for the cooperating crushing members, the section having been taken substantially along the line 1—1 of Fig. 2;

Fig. 2 is a fragmentary top view of the jaw crusher illustrated in section in Fig. 1, showing approximately one half of the machine;

Fig. 3 is an enlarged side view of the medial liner die of the movable jaw member of the same crusher;

Fig. 4 is a similarly enlarged side view of the lower liner die of the movable jaw member;

Fig. 5 is a likewise enlarged side view of the intermediate liner die or wedge of the stationary jaw member of the crusher;

Fig. 6 is a similarly enlarged side view of the lower liner die of the stationary jaw member;

Fig. 7 is a likewise enlarged top view of a fragment of the fixed jaw liner die wedge shown in Fig. 5;

Fig. 8 is a similarly enlarged top view of a fragment of the fixed jaw liner die shown in Fig. 6; and

Fig. 9 is a likewise enlarged top view of a fragment of the movable jaw liner die shown in Fig. 3.

While the invention has been illustrated and described herein as having been applied to a jaw crusher of the eccentric and toggle actuated type having only one movable crushing jaw coacting with a single stationary jaw, it is not intended to limit the use of the improved liner dies and their mountings to such crushing units; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the improved jaw crusher illustrated therein, comprises in general a rectangular main frame having upper and lower sections 11, 12 respectively, and being provided with upper and lower material inlet and discharge openings 13, 14; an upright stationary crushing member or jaw 15 spanning one side of the main frame and being provided with a medial liner die wedge 16 and with upper and lower liner dies 17, 18 cooperating with the wedge 16; an inclined movable crushing member or jaw 19 swingably suspended at its upper end from an eccentric drive shaft 20 journaled in bearings 21 mounted upon the upper frame section 11 while its lower swinging end coacts with one end of a toggle link 22 the opposite end of which reacts against a bracket 23 carried by the lower frame section 12, the jaw 19 also spanning the main frame and being provided with a medial liner die 24 cooperating with upper and lower liner dies 25, 26 to form a crushing surface coacting with the crushing surfaces of the fixed jaw liner dies 16, 17, 18 to provide a crushing chamber 27 spanning the main frame and diverging from the upper inlet opening 13 to the lower discharge opening 14; and liner die plates 28, 29 secured to the opposite sides of the frame sec-

tions 11, 12 and enclosing the opposite sides of the chamber 27.

The main frame may be formed of heavy ordinary steel plates united as by welding, and the stationary jaw 15 may be likewise formed while the oscillatory or movable jaw 19 and the toggle link 22 and bracket 23 may be constructed of durable steel castings. The liner dies for the crushing jaws 15, 19 and for the side walls of the main frame are, however, preferably formed of wear resisting material such as manganese steel; and since this material is relatively malleable it stretches or expands to a considerable extent when subjected to impact and severe pressure and it is therefore very desirable especially in large crushers having extensive crushing chambers 27 to provide means adapted to automatically compensate for such stretching or expansion of the dies which are subjected to the crushing impact. The upper and lower frame sections may be firmly but detachably united as by bolts 31 coacting with rigid flanges 32 thereof, and because the side liner plates 28, 29 of the frame are not subjected to severe crushing action they are not subject to extreme expansion and may be detachably secured to the adjacent frame side walls by means of ordinary bolts 33 in a customary manner.

The liner dies 16, 17, 18 for the fixed jaw 15 and the liner dies 24, 25, 26 for the movable jaw 19 may have corrugated crushing surfaces exposed directly to and extending downwardly along the crushing chamber 27 as indicated in the drawings, and the upper and lower liner dies 17, 18 for the fixed jaw 15 are interchangeably similar and are normally held in place by the medial wedge die 16, while the upper and lower liner dies 25, 26 for the movable jaw 19 may also be interchangeably similar and are normally held in position by the medial liner die 24.

The medial fixed jaw liner die 16 is formed as illustrated in Figs. 1, 5 and 7 with spaced central fins 35 extending into recesses in the fixed jaw 15 and forming a horizontal groove coacting with a key 36 interposed within aligned recesses in the frame sections 11, 12, and this liner die 16 is tapered as shown and is provided with parallel upper and lower outwardly directed tongues and adjoining grooves 37, 38 respectively. The upper and lower liner dies 17, 18 of the fixed jaw 15 are each provided with rear reaction pads 39 and with tongues and adjoining grooves 49 adapted to interlock with the adjacent tongues and grooves 37, 38 of their retaining liner wedge die 16, and the die 16 may be clamped to the jaw 15 by a series of immovable bolts 41, while the liner dies 17, 18 are adapted to be likewise clamped by reflectable bolts 42 passing freely through enlarged holes 43 in the frame sections 11, 12 and in the adjacent portions of the jaw 15. This assemblage is such that the medial wedge die 16 will remain fixed during normal operation of the crusher, but when the liner dies 17, 18 stretch and become elongated they will expand away from the die 16 and the pads 39 will then slide along the fixed jaw 15 while the bolts 42 will bend or flex so as to compensate for the expansion.

The medial movable jaw liner die 24 is formed as illustrated in Figs. 1, 3 and 8 with a rear central positioning pad 45 cooperable with a central recess 46 in the movable jaw 19, and with a series of laterally spaced pads 47 across its mid-portion, and all of these pads 45, 47 are clamped to the jaw 19 by bolts 48 passing through the lateral pads 47. The upper and lower ends of the liner die 24 are provided with rear recesses 49 which slidably engage projections 50 formed integral with the jaw 19, and these ends also have tongues and adjoining grooves 51 formed thereon. The upper and lower liner dies 25, 26 of the movable jaw 19 are each provided with rear reaction pads 52 at their ends nearest to the crusher inlet and outlet openings 13, 14, and with rear recesses 53 slidably engaging the jaw projections 50 at their opposite ends, and these opposite liner ends are also provided with

tongues and adjoining grooves 54 adapted to interlock with the tongues and grooves 51 of the medial die 24. The liners 25, 26 are normally held in place by bolts 55 disposed at oblique angles relative to their crushing surfaces as shown in Fig. 1, and these clamping bolts are deflectable when the liner dies 24, 25, 26 stretch or expand away from the central clamping bolts 48.

The remainder of the jaw crusher is of relatively well known construction, the eccentric shaft 20 which swingably suspends the movable jaw 19, being provided with flywheel pulleys 57 at one or both of its opposite ends. The lower swinging end of the movable jaw 15 is normally held in engagement with the toggle link 22 by means of one or more retainer rods 58 and compression springs 59, and the toggle reaction bracket 23 is adjustably supported from and secured to the rear portion of the main frame 11 by means of clamping bolts 60 as illustrated in Fig. 1. When the various parts of the jaw crusher have been constructed and assembled as hereinabove described, and properly adjusted for normal operation, the driving shaft 20 may be rotated to cause the movable jaw 19 to oscillate or swing relative to the fixed jaw 15. The material which is to be crushed may then be deposited within the crushing chamber 27 through the upper inlet opening 13, and as this material gravitates downwardly through the converging upright chamber 27 it is gradually reduced and eventually discharged through the lower outlet opening 14.

When the material is being crushed and as it slides downwardly along the corrugated crushing surfaces of the liner dies 16, 17, 18, 24, 25, 26 which are directly exposed to the chamber 27, these dies are subjected to enormous impact and pressure causing them to stretch or expand primarily in the direction of advancement of the material. Since the mid-portions of the medial liner dies 16, 24 are firmly clamped to the jaws 15, 19 by the heavy bolts 41, 48 respectively any expansion which occurs in these dies and in the upper and lower liner dies 17, 18, 25, 26 which are firmly connected with the opposite upper and lower ends of the dies 16, 24 by the coacting tongues and grooves 37, 40, 51, 54, must take place away from the central anchoring bolts 41, 48. In the relatively narrow wedge die 16 such expansion is negligible, but in the wider medial die 24 the expansion takes place along the projections 50 of the jaw 19, and the pads 39, 52 and projections 50 also permit the upper and lower end dies 17, 18, 25, 26 to expand and slide along their respective crushing jaws 15, 19, while the deflectable bolts 42, 55 also function to permit such stretching or expansion of these end dies away from their retaining medial dies 16, 24, thus effectively compensating for expansion or contraction of all of the jaw protecting dies.

From the foregoing detailed description of the construction and functioning of the improved crusher, it will be apparent that the present invention in fact automatically compensates for any distortion of the jaw liner dies while positively eliminating possible bulging of these dies which would reduce the crushing efficiency. The key 36 besides anchoring the wedge die 16 in place, also serves to facilitate proper assembly of the main frame sections 13, 14, and the formation and relative disposition of the liner clamping bolts 41, 42, 48, 55 is important in order to permit free expansion and possible contraction of the liner dies to take place.

Since the wear on the crushing surfaces of the liner dies is not always uniform, it sometimes becomes necessary to replace only certain dies when excessively worn, and the present improved sectional formation of these dies enables such partial renewal. The upper and lower dies 25, 26 of the movable jaw 19 may obviously be removed and replaced by merely manipulating the bolts 55 and without disturbing the medial liner die 24, and the medial and upper and lower dies 16, 17, 18 of the fixed jaw 15 may also be readily removed and replaced by manipulating the bolts 41, 42, and since the side

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liners 28, 29 are least subject to wear they need not be so frequently renewed. The interlocking tongues and grooves 37, 40, 51, 54 may be readily ground to insure proper coaction, and provide firm connections between the adjacent liner die sections.

While the improved liner die assemblage is primarily usable in large jaw crusher units having extensive crushing surfaces, it may also be advantageously applied to other types of crushing machines having wear resisting liners of considerable area, and the invention has gone into successful use and has considerably increased the crushing efficiency while also greatly facilitating the making of necessary repairs.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise functioning of the jaw crusher liner assemblage, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form a crushing chamber, a protective liner comprising a medial die and two other dies adjoining opposed ends of the medial die carried by each of said members and facing said chamber, the adjoining ends of said medial and opposed dies being formed to positively interlock, and means for anchoring each of said medial dies to its carrying member, the portions of said liners on opposite sides of said anchoring means being free to expand and contract away from and toward said means.

2. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form an upright crushing chamber having an inlet at its upper end and an outlet at its lower end, a protective liner comprising a medial die and other dies adjoining the upper and lower ends of the medial die carried by each of said members and facing said chamber, the adjoining ends of said medial and opposed dies being formed to positively interlock, and means for anchoring each of said medial dies to its carrying member approximately midway between said upper and lower ends, the portions of said dies above and below said anchoring means being free to expand and contract away from and toward said means.

3. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form an upright crushing chamber, a sectional protective liner die carried by each of said members and facing said chamber, each set of adjoining ends of said die sections being formed to positively interlock, and means for anchoring a medial section of each of said dies to its carrying member, the sections of said dies remote from said anchoring means being free to expand and contract relative to said means.

4. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form a crushing chamber, a protective liner die carried by each of said members and facing said chamber, each of said dies comprising a medial die and opposite end dies formed to positively interlock with the adjoining ends of the intervening medial die, and means for anchoring the medial die of

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each of said liner dies to its carrying member, the end dies on opposite sides of said medial dies being free to expand and contract away from and toward said means.

5. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form an upright crushing chamber having an inlet at its upper end and an outlet at its lower end, a protective liner die assemblage carried by each of said members and facing said chamber, each of said die assemblages comprising a medial die and upper and lower end dies formed to positively interlock with the adjoining upper and lower ends of the intervening medial die, and means for anchoring said medial dies to their carrying members approximately midway between said inlet and outlet, said upper and lower dies above and below said anchoring means being free to expand and contract away from and toward said means.

6. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form a crushing chamber, a composite protective liner die assemblage carried by each of said members and facing said chamber, each of said assemblages comprising a medial die united by a tongue and groove connection with opposite end dies, and means for anchoring a medial die of each of said die assemblages to its carrying member, the end dies of each of said assemblages being free to expand and contract relative to said anchoring means.

7. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form a crushing chamber, a protective liner die carried by at least one of said members and facing said chamber, said die comprising a fixed medial section and movable opposite end sections, and laterally deflectable bolts for anchoring each of said end sections to its carrying member, the portions of said end sections remote from said medial section being free to expand and contract relative to said carrying member.

8. For use in a crusher having a frame and a pair of relatively movable crushing members mounted upon the frame and cooperating therewith to form an upright crushing chamber having an inlet at its upper end and an outlet at its lower end, a protective liner die comprising upper and lower dies and an intervening die carried by at least one of said members and facing said chamber, the adjoining ends of said dies being interlocked, and laterally deflectable bolts for anchoring the medial portions of said upper and lower dies to said carrying member.

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