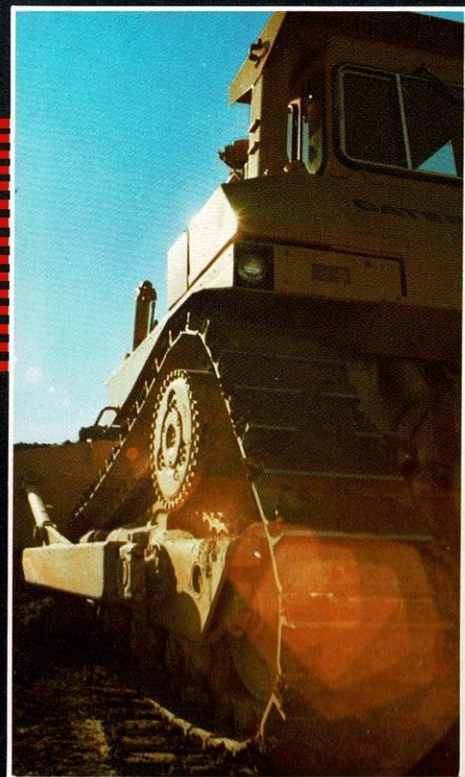


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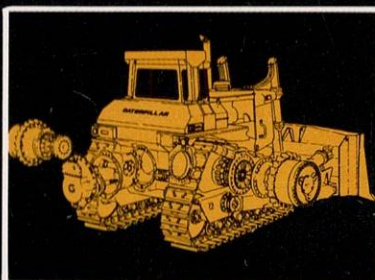
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
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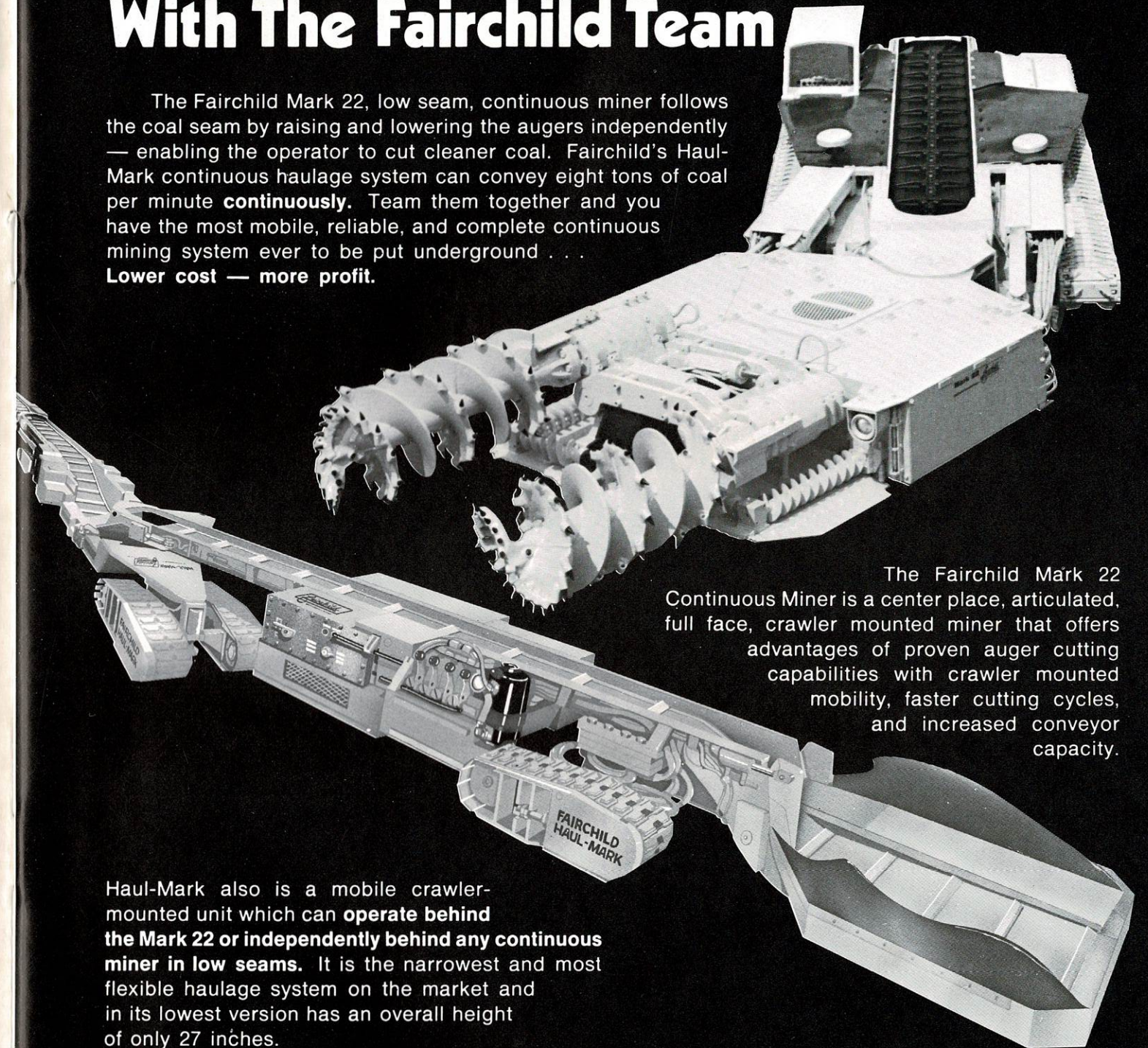
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Green Lands

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Our Cover — Among the legacies of the late Carl DelSignore is the ongoing and outstanding reclamation work of his mining companies. On our cover is a Davis Trucking operation in Tucker County.



Editor
R. Daniel Miller

Business
Mary Ann Steele

Green Lands is a quarterly publication of the
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1624 Kanawha Boulevard East,
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Telephone ((304) 346-5318

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Editorial

DoE Will Succeed Despite Critics

In the summer of 1984, candidate Arch A. Moore, Jr. proposed a new department for West Virginia State Government, a "Department of Energy," designed to consolidate the authorities and responsibilities of the State's various agencies empowered to regulate extractive industries.

The idea was dutifully reported by those assigned to cover the campaign, but really, nobody paid much attention.

In the winter of 1985, Governor Arch A. Moore, Jr. addressed the West Virginia Legislature, and again he proposed a Department of Energy, one which he felt would be responsive to efficiency oriented renovation, without compromising the environmental and mine safety considerations built into existing law.

Common legislative courtesy dictates that the Governor's proposals be formally introduced to the Legislature, and this was done. Still, the smart money was not on a West Virginia DoE in 1985. Any speculation that the "energy bill" would become law rode strictly on Arch Moore's reputation for getting things done.

Suddenly, as a relatively uneventful legislative session ground towards a conclusion, the energy proposal picked up momentum. At this point, the "Citizens Opposed to Anything of Possible Benefit to Industry," became concerned.

When it was learned that people with knowledge of both law and coal

were involved with drafting a bill dealing with coal law, they were offended.

When the bill not only rolled through both houses of Legislature, but was enacted in substantially the form preferred by the Governor, the self-appointed public guardians were beside themselves, which was not a pleasant place to be at that time.

Opponents of Arch Moore, of the coal industry, and of the concept of an energy department grasped at all the straws available to them. "The bill compromises safety," they said. "It does away with environmental protection," they warned. "It's full of technical errors; it will never work; OSM will never approve," and on and on.

No one has yet been able to cite a specific instance where mine safety or environmental protection was compromised by the bill. That was a smokescreen thrown up to occupy headlines while further flaw-searching research was ongoing. And the papers cooperated.

But one of Governor Moore's most useful skills is his ability to deal with political opposition, and media criticism. Mostly he just ignores them. He simply refuses to be guided by morning headlines in setting policy. And so the headlines came, and went, and didn't have much impact on the real world.

But for DoE's opponents, OSM was the ace in the hole. Anyone who has followed the story of mine

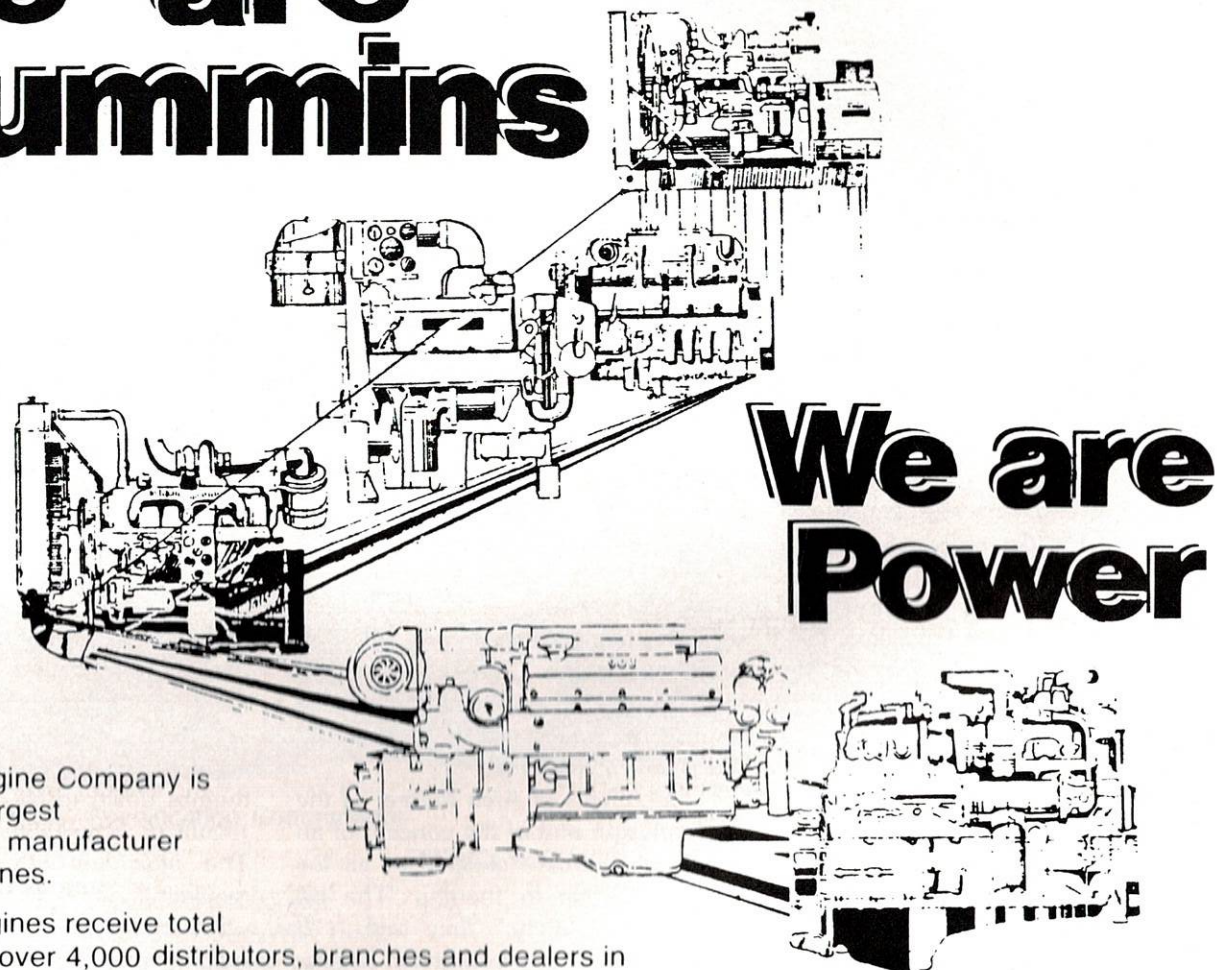
regulation over the last decade knows that it has been a tooth and nail struggle to get the federal government to admit that the most advanced State in the art of mine reclamation knows what it is doing, on both sides of the regulatory fence.

On the surface, it was a reasonable assumption that OSM would turn thumbs down to WV-DoE. And that meant no regulation, said the citizens. The new law supersedes existing regulation, and if the new agency is shot down by the feds, then that leaves no regulatory authority, and West Virginia will be bulldozed into oblivion by night-fall.

That line of thinking reflected a very shallow knowledge of the governmental process. Arch Moore knew, and Ken Faerber knew, and Ben Greene knew, that OSM would not rubber stamp the West Virginia Energy Bill. But they also knew that the approval process would be one of negotiation and compromise, and that eventually WV-DoE would be the primary regulatory authority for coal mining in West Virginia.

And that's the way it's developing. DoE is open for business, and doing nicely, thank you. Conditional approval has been granted, the necessary adjustments will be made for the state agency to win final and permanent authority. Then the headline grabbers will seek out a new issue.

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The 1985 U.S. Energy Picture... The Recovery Is Mighty Slow

By Dr. John J. McKetta, Jr.

Joe C. Walter Professor of Engineering
University of Texas at Austin

GENERAL

In 1984 we had the first total energy usage increase since 1979. The overall total production of energy in 1984 increased slightly from '83 and is at the same level of that of 1970.

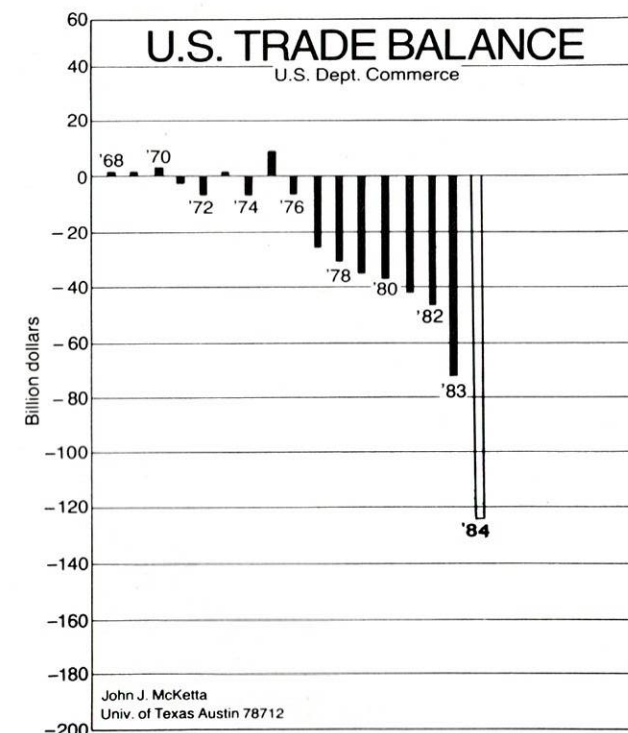


Figure 2 U.S. Trade Balance

The U.S. suffered another horrible trade deficit. The deficit in 1984 was \$126 billion compared with \$69.4 billion in 1983 and \$46.1 billion in 1982. This is shown in Figure 2. (The figures are numbered the same as those in the 1983 U.S. Energy Report.) In Figure 3 can be seen that there was about a 5% increase in the use of total energy in 1984, while the total production also increased about 2.9%.

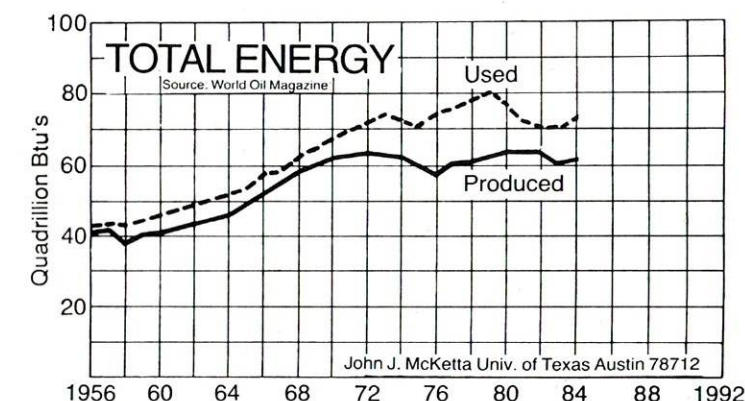


Figure 3 Total Energy Used in the U.S.

Figure 4 shows the natural gas industry has not recovered from the full usage of 24.2 quadrillion Btu's in 1972. The usage figures continues a downward trend through 1984, but 1985 should see about a 2% increase in usage.

GREEN LANDS 7

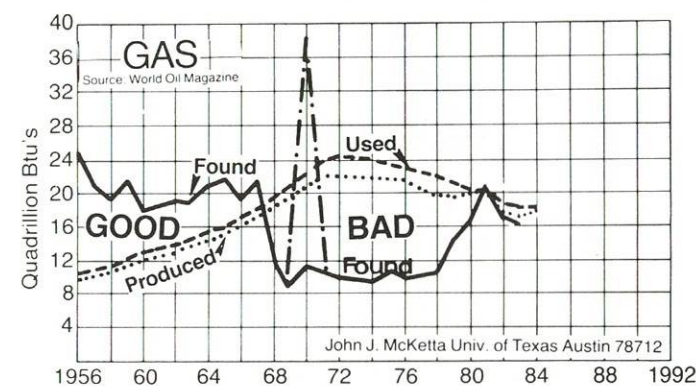


Figure 4 Natural Gas Used, Produced and Found in the U.S.

From Figure 5 can be seen that the use of oil and natural gas liquid increased about 4.9% and the production increased about 3% from 1983 figures. Figure 7 shows that the total wells drilled in 1984 were 81,500 compared with 79,100 in 1983. The peak was in 1982 at 88,000 wells. The new field wildcat wells were at record high in 1984. There were 13,510 new field wildcats drilled in 1984 which is the highest since the previous record of 12,400 drilled in 1956.

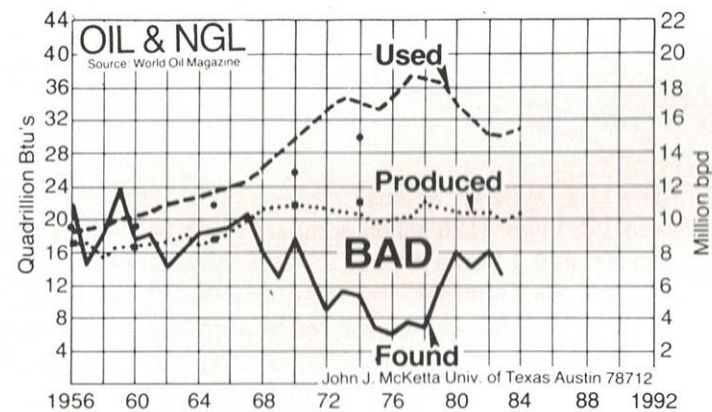


Figure 5 Oil and Natural Gas Liquids Used, Produced

Unfortunately, most of the new oil usage was based on imported oil. The imported oil increased about 4.7% in 1984 over 1983. This can be seen in Figure 6. Also shown in Figure 6 is a dotted line which indicates the maximum oil imports recommended by the first National Energy Policy Committee in 1970. The cost of imported oil in 1984 exceeded \$57 billion.

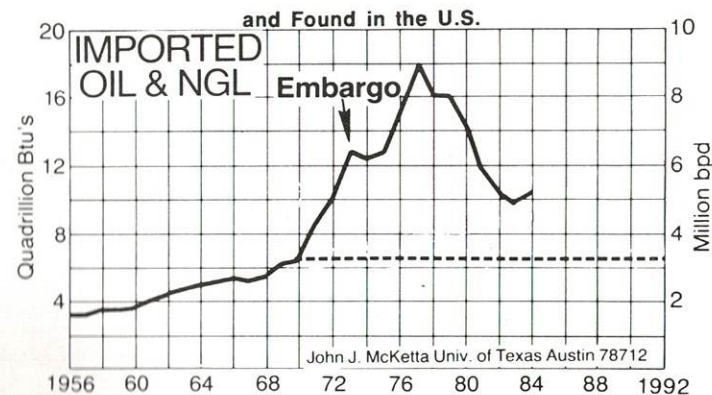


Figure 6 Oil and Natural Gas Liquids Imported into the U.S.

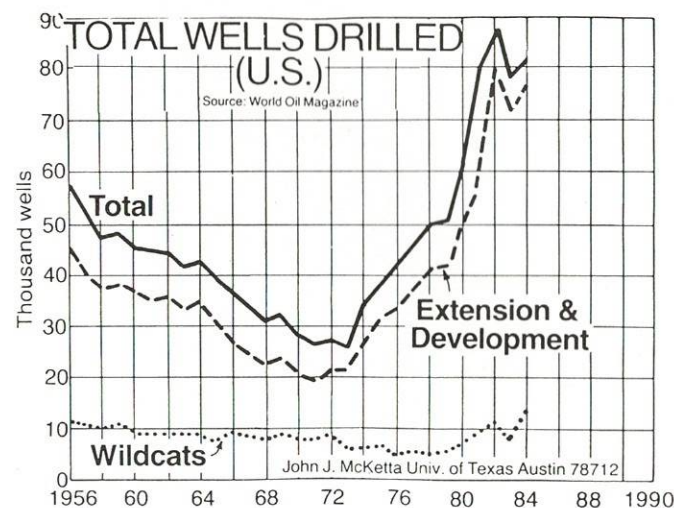


Figure 7 Total, Development and New Field Wildcat Wells Drilled in the U.S.

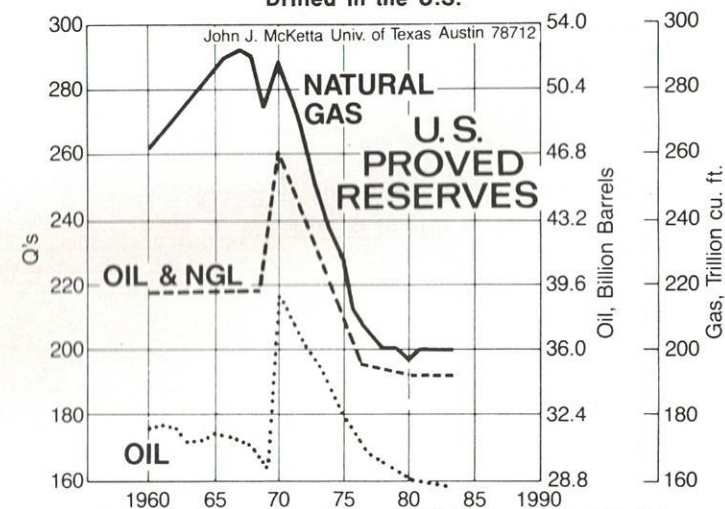


Figure 9 Proved Reserves of Oil, Natural Gas Liquids and Natural Gas in the U.S.

There was also a decline in 1984 in the U.S. proved reserves of natural gas, oil and natural gas liquids. This is shown on Figure 9. Figure 10 shows that both the coal produced and used in 1984 was at record heights with 848 million tons produced and 775 million tons used.

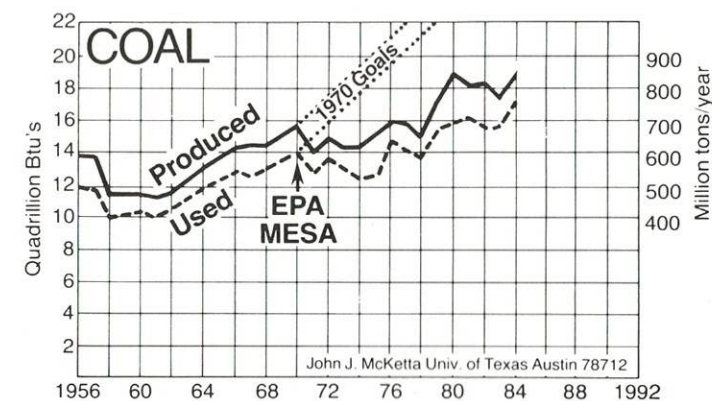


Figure 10 Coal Produced and Used in the U.S.

Although there have been no new nuclear reactor orders placed since 1979, overall 1984 was a good year for nuclear

power. For example, six new nuclear power plants received full power operating licenses, three new plants went into commercial operation for the first time, the nuclear power production grew 13% over 1983, and accounted for a record 325 billion kilowatt hours in 1984 (14% of the nation's electricity), the nuclear generating costs in the U.S.A. were at parity with coal (averaging 3.5 cents per kilowatt hour). Also, four long embattled nuclear plants gained some relief when the Long Island Electric Company facility at Shoreham, Long Island, New York, was given permission to load fuel, a complex financial plan was developed for the Seabrook I nuclear plant in New Hampshire, Commonwealth Edison's Byron I nuclear plant in Illinois was started up, and the Diablo Canyon in California got a full-power license. The U.S. Supreme Court affirmed Federal Supremacy in commercial shipments of radio active materials removing the threat that local jurisdiction could paralyze nuclear shipments. The voters in Missouri, for the second time in four years, defeated by a resounding two to one vote, a potentially crippling initiative by the anti-nuclear people that could have closed one nuclear plant and placed a legal cloud over another. The disappointments in nuclear power include the cancellation of the Zimmer nuclear plant in Ohio, the Marble Hill plant in Indiana, four reactors under the TVA jurisdiction, and the continued inaction of the Nuclear Regulatory Commission in giving Three Mile Island Unit 1 permission to restart.

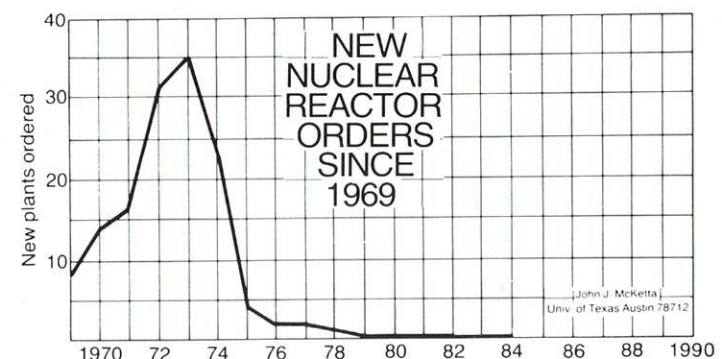
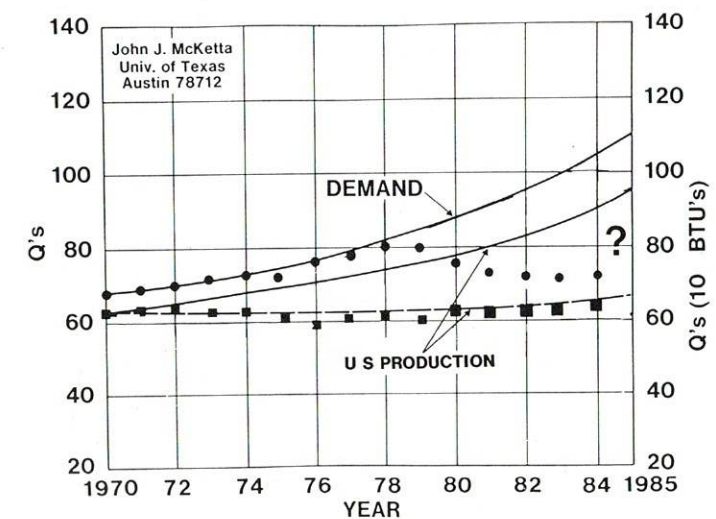


Figure 11 New Nuclear Reactors Ordered in the U.S.

Finally, the actual versus predicted U.S. production and demand curves of total energy are shown in the last figure. The two top solid lines were made in 1969 by three different groups:

The McKetta U.S. National Energy Supply Committee, the National Petroleum Council, and the Love-Simon group. Later, in 1972, McKetta predicted that the U.S. production would be much lower and is shown as the dashed line. The actual demand in U.S. production data are shown by the circles and squares for the years 1970 through 1984. One can see that the demand curve followed very closely to the actual demand for 8 years until the recession of 1979 and 1982.



Actual vs Predicted Supply and Demand of Total Energy in the U.S.

Since it is unlikely that the U.S. will regain any of the lost high energy industries (we are importing large quantities of steel, aluminum, copper, etc.), the demand curve will not reach the predicted demand line through the year 2000. The lower (dashed) U.S. production curve was inordinately accurate through 1984. One can see that the overall U.S. production of energy did not increase significantly during the 15 year period.

WHAT CAN BE DONE TO EASE THE ENERGY PROBLEM?

The recommendations in 1985 are the same as the recommendations made in 1970. These are outlined in detail starting on page 16 of the 1983 McKetta Energy Report ("1983 U.S. Energy Picture -- We're Still in Trouble" -- obtain from National Council for Environmental Balance). In addition to the detail suggestions, the recommendations are the same as they were in 1955, 1965, 1970, 1975, 1980:

- Reconsider our priorities.
- Turn the energy exploration, production and distribution over to those who understand what they are doing.
- Ease up on the extreme environmental demands. We do want clean air but we can't have essentially zero pollution. Neither can we ever realistically achieve a zero risk.
- Let the market place determine the price and the choice of fuel to be used and where it is used.
- Let the various energy producers decide on whether they should use gas or coal or shale or whatever source.
- Let's go back to a free, competitive system where the various energy companies will compete, and you and I will select the winners of the competition.
- Let's go back to the free enterprise system that once made this country the greatest in the world.

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Three Wars,
An Oil Embargo,
Runaway Inflation,
A Recession And
Eight Presidents.

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Andy Teeter, McDonough Caperton Insurance Group.



Wayne H. Stanley, Stanley Industries, Inc.



David W. Lanham, Lanham, O'Dell & Constantino, Inc.

Keating Assumes Chairmanship

Dwight M. Keating of Barbour Coal Co., Clarksburg, is the new chairman of the Association's Board of Directors. He was elected at last month's 19th Annual Meeting at the Greenbrier Hotel in White Sulphur Springs.

Another noteworthy event coming out of the meeting was the deletion of the word "Surface" from the name of the Association. The organization will henceforth be known as the West Virginia Mining and Reclamation Association. The name change was approved by the membership, according to President Ben Greene, "to better reflect our role in the coal industry, the makeup of our membership, and the reality of an integrated West Virginia coal industry in the 1980's."

Dwight Keating is a native of Massachusetts. He has previously served the Association as secretary and 1st vice chairman. He was elected for a one year term, to succeed Chairman

Carl DelSignore of Buffalo Coal Co., Bayard.

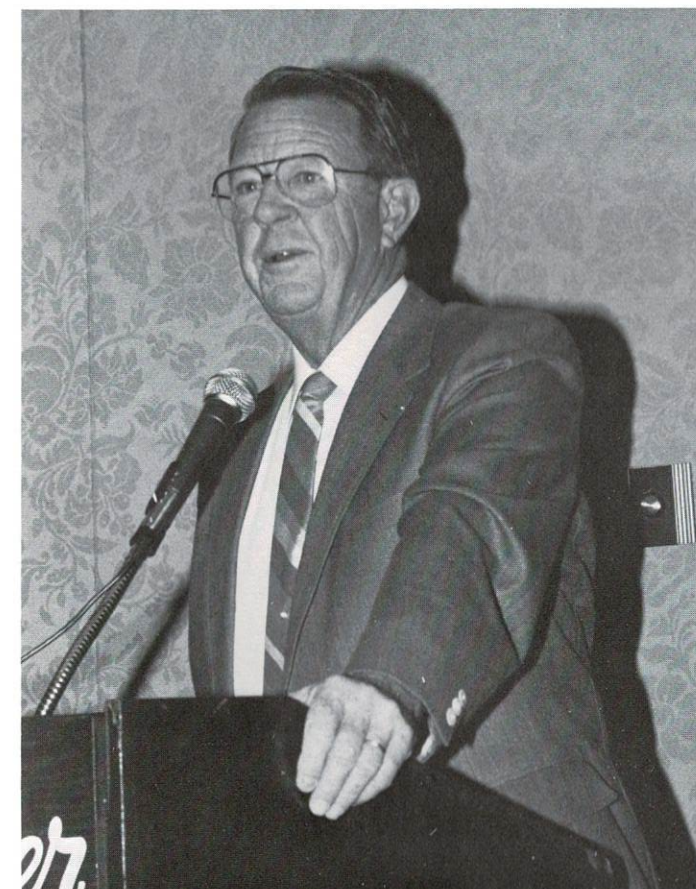
Succeeding Dwight as 1st vice chairman is Max A. Messenger of Daugherty Coal Co., Inc., Terra Alta. Other elected officers for 1985-86 include 2nd Vice Chairman Theodore J. Brisky of Bethlehem Mines Corp., Charleston; Secretary James W. Anderson of Anderson & Anderson Contractors, Inc., Princeton; Treasurer Floyd Canfield of Hobet Mining, Inc., Madison; and Associate Division Chairman Frank W. Vigneault, of Cecil I. Walker Machinery Co., Charleston.

In addition to Max and Floyd, four other men were re-elected to terms on the Board of Directors, including William C.M. Butler, III of Princess Susan Coal Co., Charleston; James C. Justice of Bluestone Coal Corp., Beckley; Rogers C. Stevens, Jr. of LaRosa Fuel Co., Inc., Clarksburg; and Charles T. Jones of Amherst Industries,

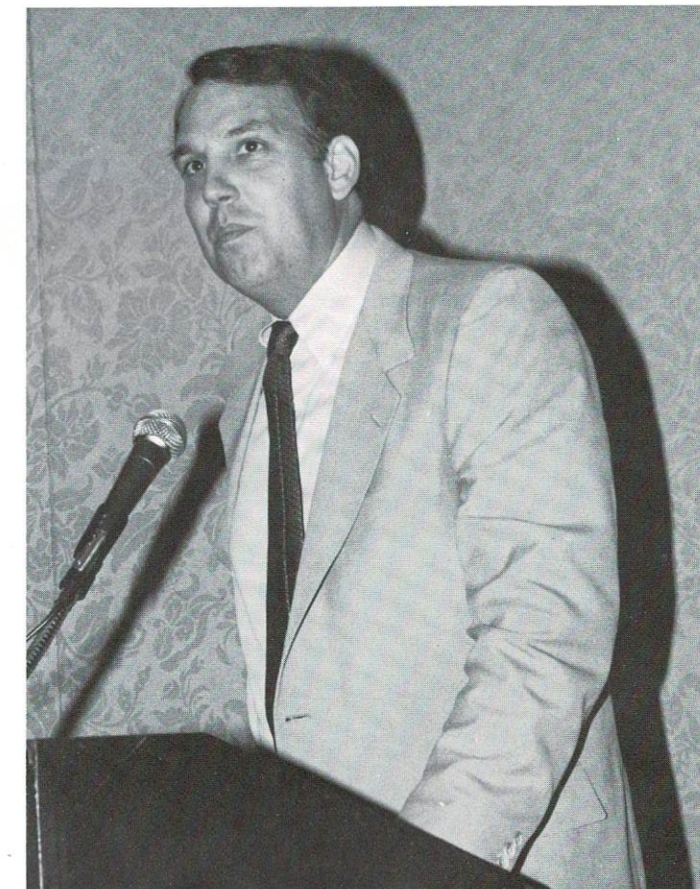
Inc., Charleston.

Four other individuals were newly elected to the Board. These include Frank Vigneault, James R. White of Pioneer Fuel Corp., Beckley; John Bryan of the Pittston Coal Group, Lebanon, VA.; and Paul F. Hutchins of Freeman Branch Mining, Columbus, OH.

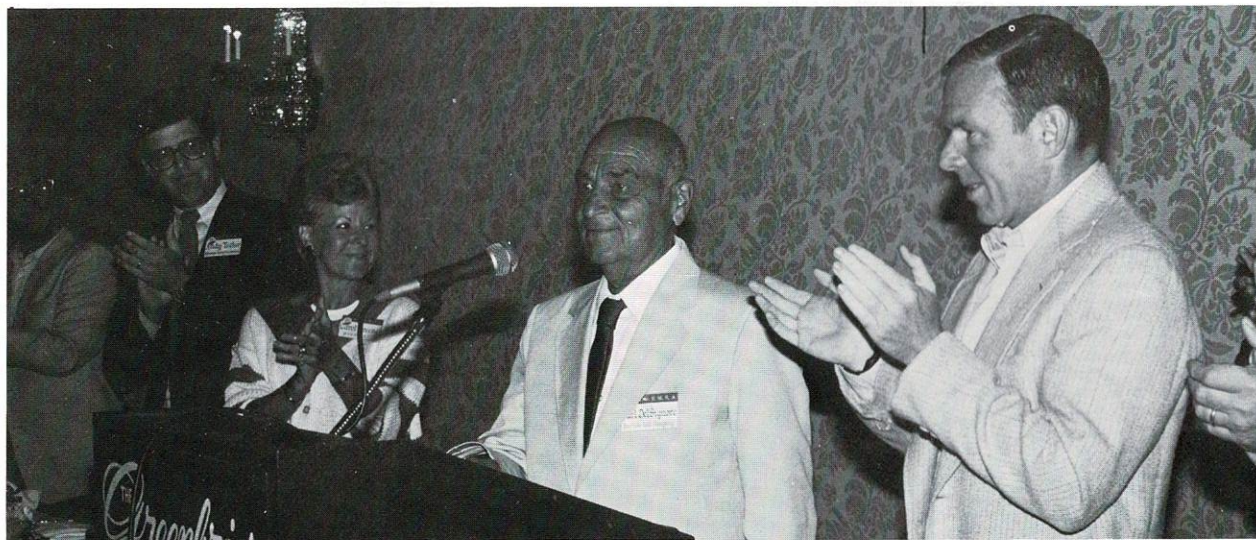
The Association also welcomed six new members. In the General Division the new member is Use Coal Inc., represented by Daniel C. Minnix of Clarksburg. In the Associate Division, the new members are Coal Field Machinery, Inc., represented by Joe Ison of Beckley, D-A Lubricant Co., Inc., represented by Mark Oatridge of Charleston, Hancor, Inc., represented by Mike Revill of Allison Park, PA., Lanham, O'Dell & Constantino Inc., represented by Frank L. Constantino of Beckley, and Palco, Inc., represented by Debbie Gillespie of Winfield.



William S. Ritchie, Jr., Commissioner, WV Department of Highways.



Kenneth R. Faerber, Acting Commissioner, WV Department of Energy.



Board Chairman Carl DelSignore gets a well deserved standing ovation from Association members at the chairman's breakfast.



Tracy Hylton, above left, and Buck Harless, below left, received brass flame safety lamps from the Citizens to Promote West Virginia Coal, in recognition of their fundraising efforts in individual and statewide races, respectively.



Carl DelSignore, WVMRA, Chairman of the Board, 1984-85.



Newly Elected Chairman Dwight M. Keating assumes the podium.

Carl DelSignore 1920-1985

The Association was saddened, and considerably lessened, by the death of Carl DelSignore, who had just completed a courageous and productive term as chairman of the Board of Directors.

He was, by any standard, a hugely successful businessman. That success gave him the choice of living anywhere, in any style. But, he was a West Virginian, through and through, and he chose to keep his home near his roots, on the eastern slopes of the Appalachian Mountains.

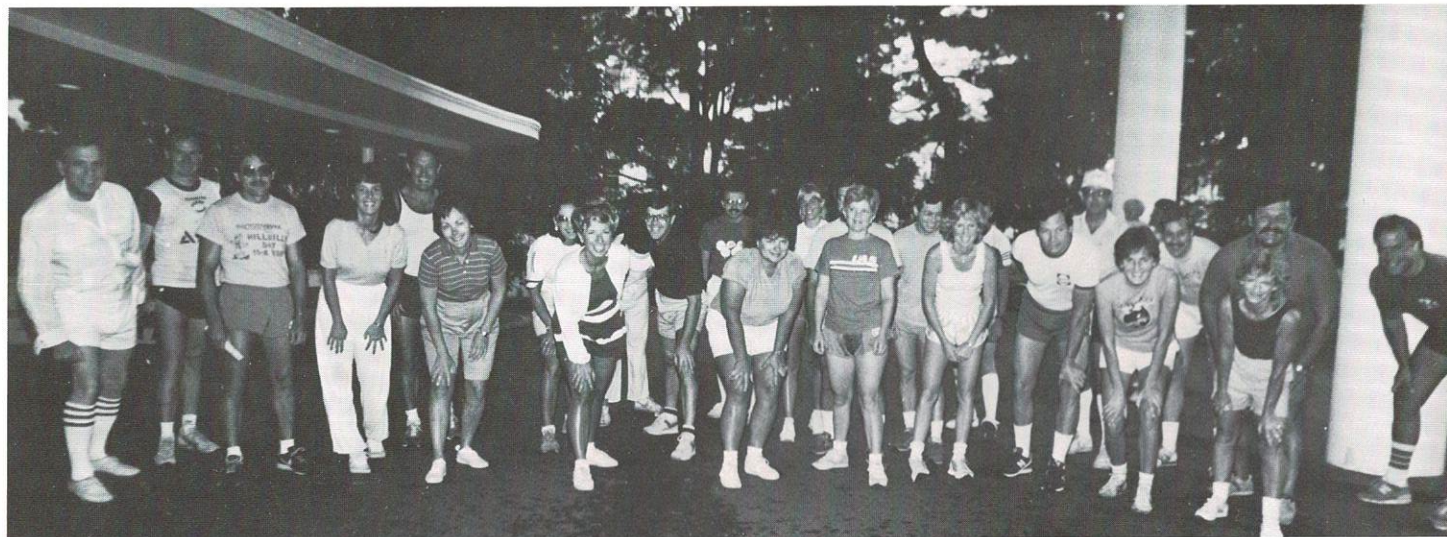
He was a man who could delight an audience of one or one thousand with tales of an earlier time in the mining industry. He was much less comfortable at the podium, but he clearly saw his duty as a leader within the Association, and even declining health did not divert him from assuming the mantle of the chairmanship when it came his turn to serve.

Carl DelSignore built his business and his reputation on the qualities of vitality and strength. His cornerstone companies, Buffalo Coal Co. and Davis Trucking Co., Inc. are models of the state of the art in surface mine reclamation.

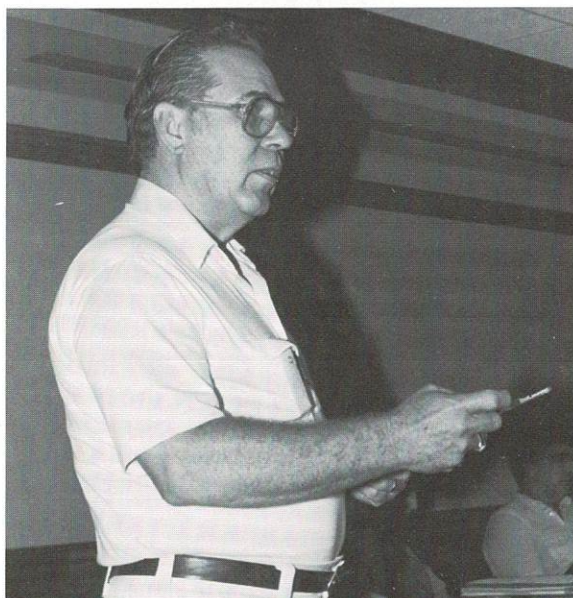
His abilities and priorities will always be reflected in those companies, and, as such, he will remain a living reminder of the viability of a progressive, community minded employer who found, and proved, that profitable mining and a respect for West Virginia's natural beauty can, and should be, successfully integrated.

The passing of Carl DelSignore represents the coming end of the era of pioneering spirit within the West Virginia mining industry. A man of his stature cannot be replaced, but as a new generation of leaders come to the front of the industry, it will have his example to follow, and his spirit to inspire, and his success on all fronts to emulate.

Carl DelSignore's legacy will take many forms. The State of West Virginia will continue to benefit from his good works. Those who knew him by reputation will respect and admire his accomplishments. And those who knew him on a personal level will simply remember him, and the memories will bring a smile.



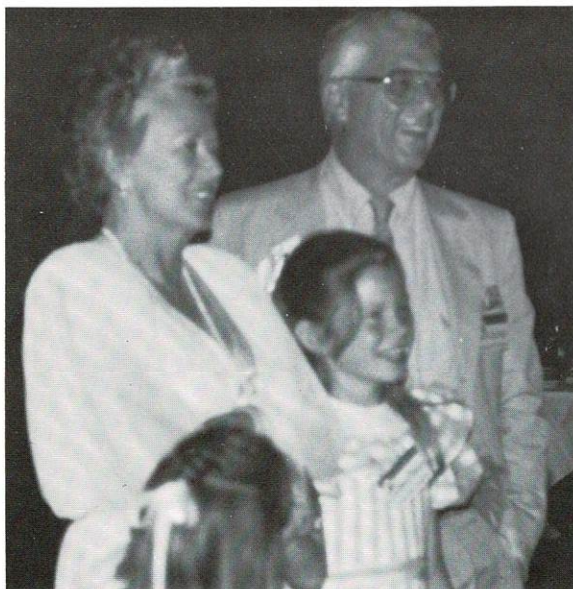
Some two dozen participants prepare to take off for the Fun Run, now an annual event. The 7:00 a.m. starting time drastically reduced the number of spectators.



Outgoing Treasurer Ted Brisky addresses finances at the membership meeting.



The Fun Run ends with a "photo finish," as Terry Morrison, Bev Sturm and Debbie Miller cross the finish line together.



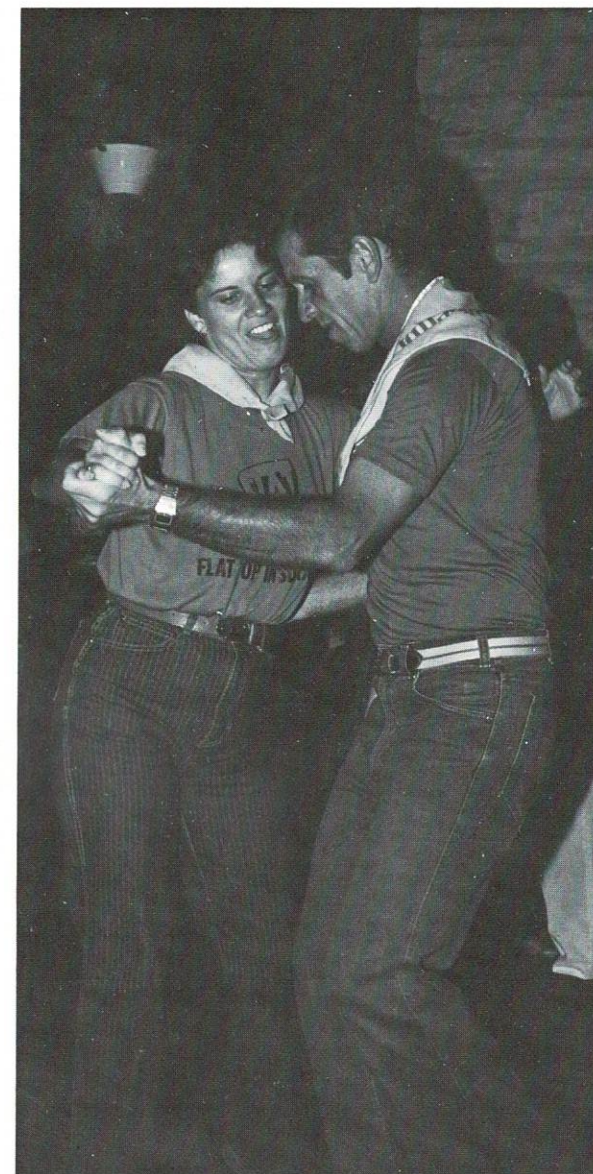
Jeanne Hamilton, celebrating a birthday, listens to a serenade from three well known musicians. Standing with "Momma Jeanne" are granddaughters Meredith and Courtney Moran and brother Bob George. The objects of her attention are Benny Benack, husband Lawson, and son Trip.



Their duties behind them for another meeting, our outstanding golf "chair-people" Betty and John Rader found time to relax together on Kate's Mountain.



Ivor Sheff, bandleader of "The Production Company," coaxes Lawson Hamilton into a rendition of the West Virginia Anthem, also known as "Country Roads." Sheff was soon to regret encouraging audience participation.



Dancing of nearly every description can be seen at the "Coal Miners' Party," including some good old fashioned country clogging.



Steve Walker, left, prepares to steal the show.



Steve Walker, joins the band to invoke the sounds of the mid 60's and Chuck Jackson with "I Don't Wanta Cry."



The talented band had no trouble adapting to Steve's specialized style.



"I Don't Wanta Cry."

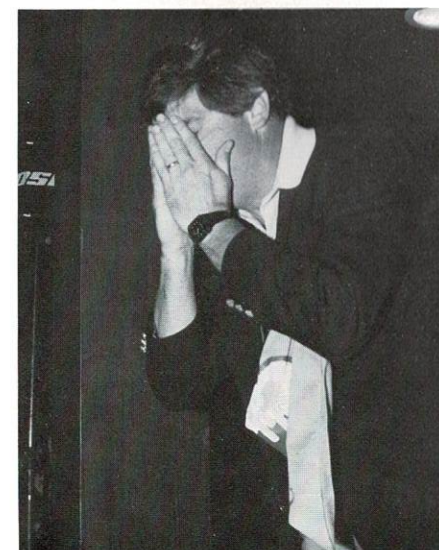
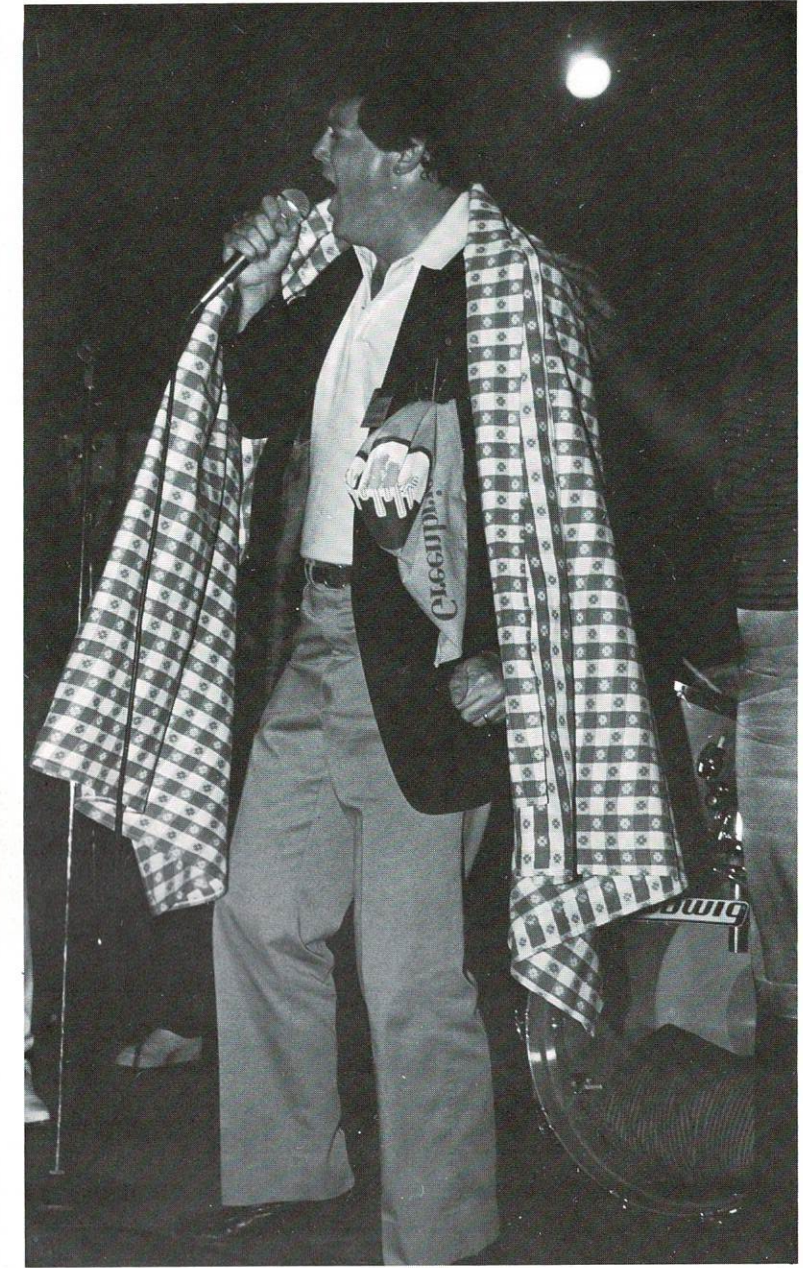
'He don't Wanta Cry'



"No, darlin', no darlin', no mo-o-o-re."



Steve was not in the least intimidated by the addition of a tablecloth to his act.



Overcome and spent at the end of the number, the Star of Kate's Mountain makes his exit, stage right.





High Power Energy lived up to its name, showing up at the "Coal Miners' Party" in sufficient force to capture the 2nd Annual "Company Pride Award." Front and center Courtney Moran holds the bronze lunchbucket symbolic of the title.

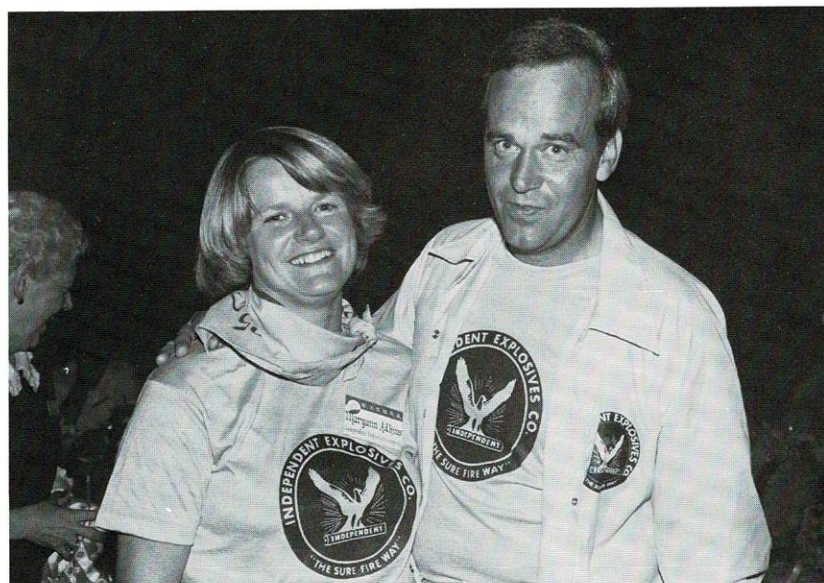
1985 WINNER 'COMPANY PRIDE AWARD'



Grafton Coal, who held the Company Pride bucket for the past year, receives a permanent plaque, symbolic of their achievement. Association President Ben Greene, makes the presentation to the best looking of the Grafton bunch, Elizabeth Compton.



The prize for the most authentic looking miner went to Don Woodward of Mt. State Bit Service. MOST of Don's gear is standard issue mine equipment.



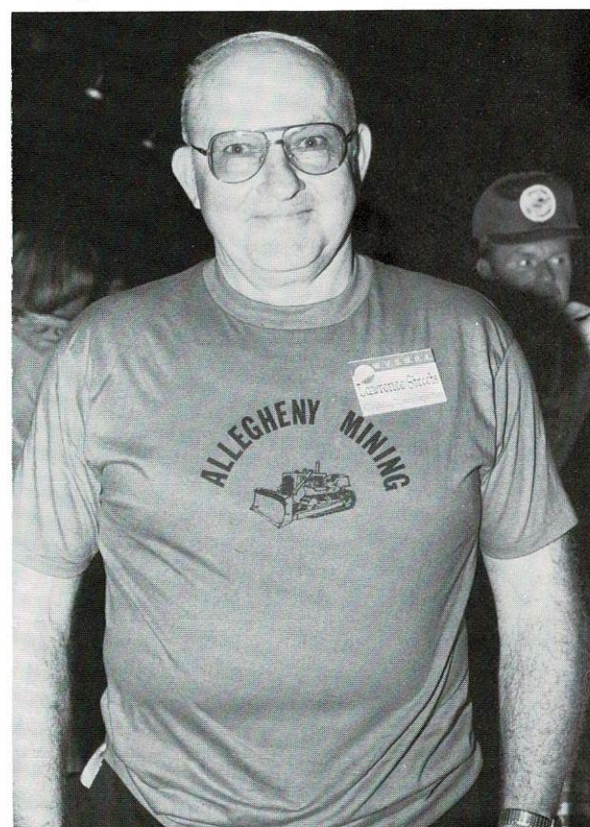
Maryann and Don Adkins of Independent Explosives Co.



Stormy Dale and Ardle McMillion of Flat Top Insurance.

COMPANY

Lawrence Streets beams his pride in Allegheny Mining.



PRIDE

Ginger Bruce, Mary Ann Steele, and Patty Bruce all have pride in the Association, and well they might. Patty and Mary Ann have 33 years of service between them, and Ginger has grown from a toddler to a nurse during her mother's career.

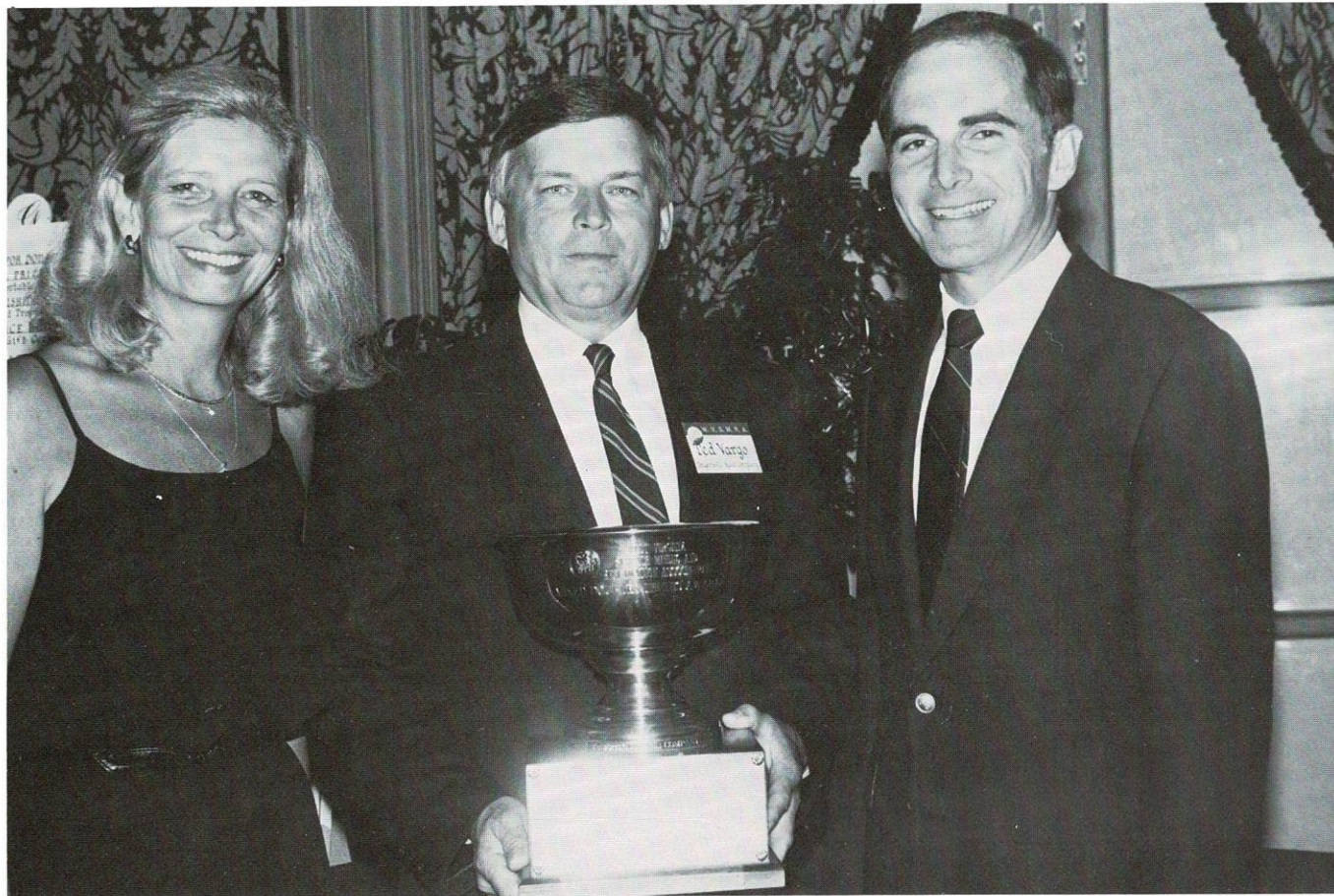


Bowling -- Sandy Flanigan (l) of Euclid Division/Clark Michigan was the top lady bowler, and Debbie Stevens accepted the men's award for husband Chester of Amherst Coal Co.

WINNERS



Fishing -- Fishing Chairman Jick Caldwell (c) of Colony Bay Coal Co. presents the top fishing awards to Charlie Miller of West Virginia Explosives and Lisa Shropshire of Sil Smith-Gruner.



Ted Vargo (c) of Ingersoll-Rand Co. with the new Mixed Doubles rotating trophy which his company donated for the tennis competition. Flanking Ted are the first winners of the award, Donna Vargo of Ingersoll-Rand and Greg Gorrell of Jackson, Kelly, Holt & O'Farrell.



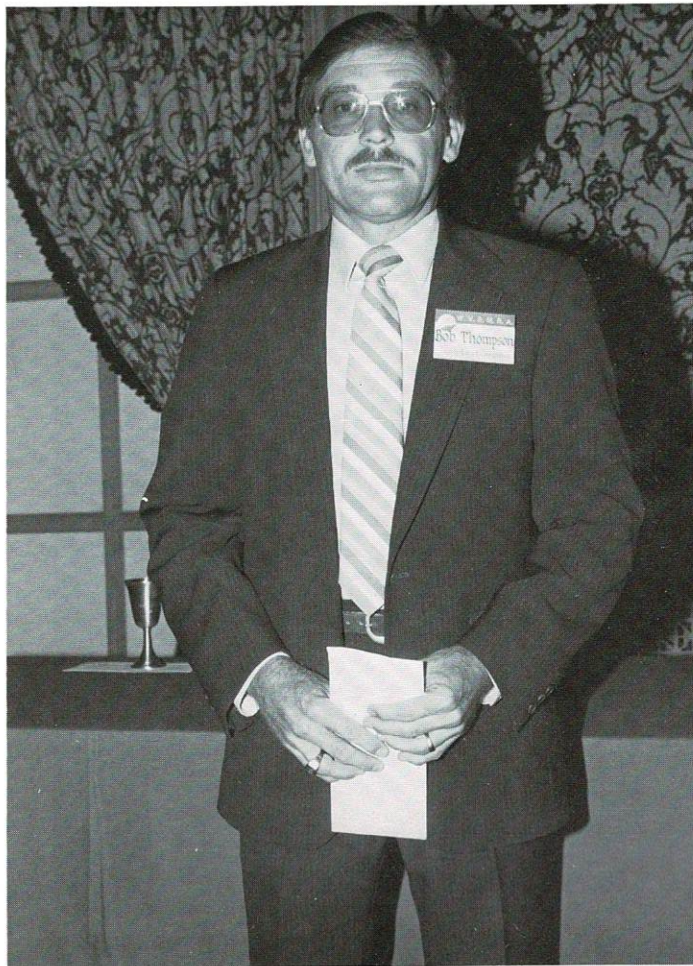
Tennis -- Ladies Double champion Donna Vargo of Ingersoll-Rand, Men's Doubles champ John Sturm of Sturm Environmental Services, Men's Doubles runnersup John Skidmore of Barbour Coal Co., and Larry Roberts of Penn Line Service, and Ladies Doubles runnersup Terry Morrison of Toothman, Rice & Co., and Jenny Roberts of Penn Line Service.



Ladies Golf -- The winning foursome under the Queens Choice format, left to right: Mary Snyder of Beckwith Machinery Co.; Mary Alice Vigneault of Cecil I Walker Machinery Co., Johnsie Tucker of Ireco Inc., and Becky Woodward of Mt. State Bit Service.



Men's Golf -- Low Net winner Dick Bolen of Patriot Mining Co. and Low Gross Winner John Rader of Union Carbide Corp.



Fun Run -- The fastest mile-and-a-half at the meeting, Bob Thompson of Lynn Land Co.



Ladies Trap -- Class B winner Margo Teeter of McDonough Caperton. Class C winner Lynn Dulaney of Starvaggl Industries, and Class A winner Delores Williams of Willco Reclamation.



Men's Trap -- Class A winner Warren Hylton of Perry & Hylton, Inc., Class B winner Keith Larew of Coaltrain Corp., and Class C winner, Wayne Stanley of Stanley Industries.

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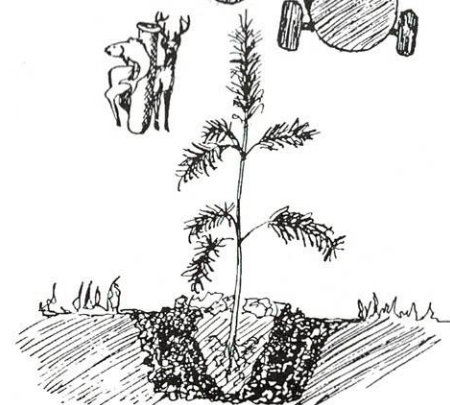
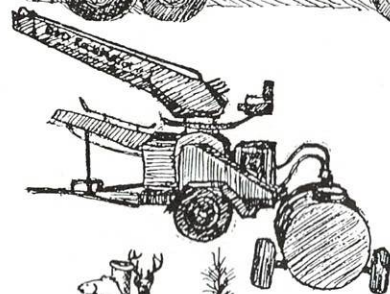
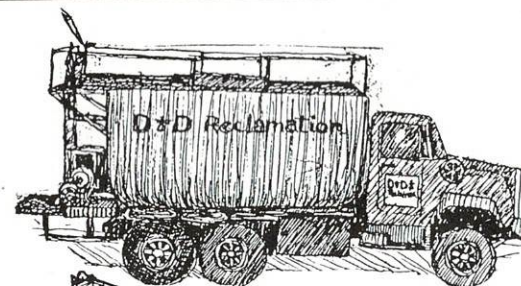
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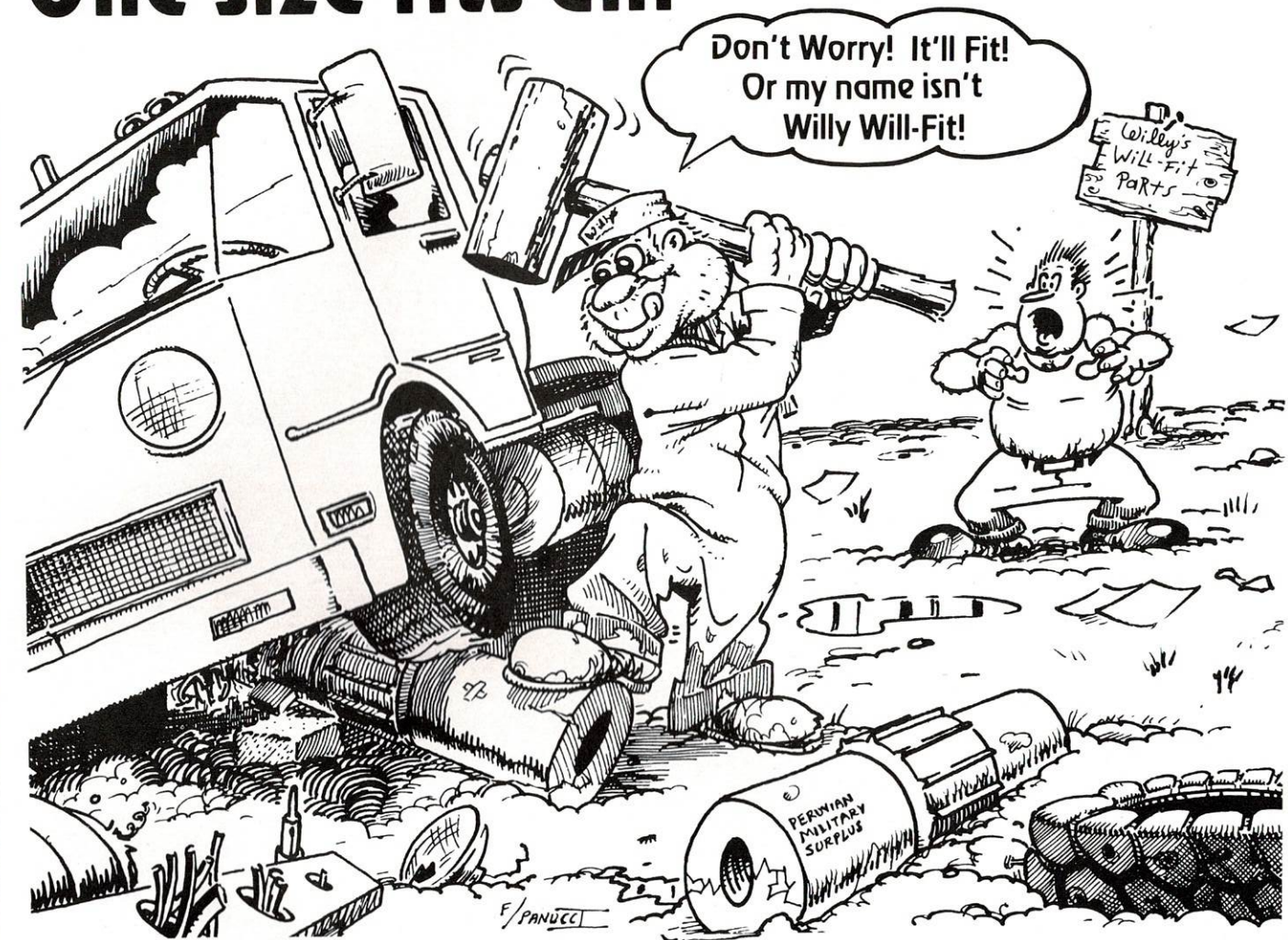
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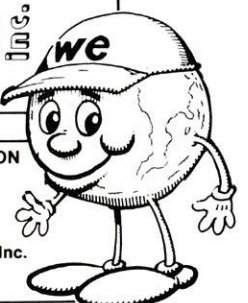
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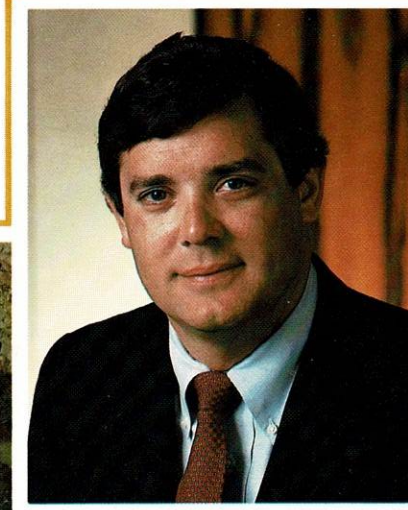
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Postbond Improvement of Cool-Season Grasslands

by K.L. Wells
Department of Agronomy
University of Kentucky

The question often arises as to how best to manage grasslands which have been established on areas disturbed by surface mining, after the bond is released. Although the "spoil" material on which much of this grassland occurs may not yet be altered to what would be considered as "soil," it still must be considered as the growth medium for plants. As such, management techniques for improvement are essentially the same as those used on soils.

Improving grasslands may mean different things to different people. As used here, the term "grasslands," refers to a dominant perennial grass sward. Improvement of this sward can be brought about by such management techniques as liming, fertilizing, renovating with legumes, clipping, strip-grazing, reseeding or interseeding with more productive species, etc. This discussion of grasslands improvement is only from the agronomic standpoint. It includes fertility systems as they relate to (1) total feed production per acre per year, (2) seasonality of production, and (3) quality of production.

CONCEPTS INVOLVED IN PLANNING FOR GRASSLANDS IMPROVEMENT

In setting up a fertility program for grasslands improvement, the objective is to produce livestock feed on a least-cost basis for a particular livestock enterprise. In deciding what fertility management practices to use for grasslands improvement, there are some basic concepts around which decision making should be centered. These are:

1. "Improved production" should be planned in terms of when, how much, and what quality of additional feed is needed. This will relate largely to the nature of the livestock enterprise for which the feed is being produced.
2. Plant species in grassland swards require essential nutrients just as any other crop. If availability

of any essential element is limited, then lack of that element limits total agronomic production. In other words, if grasslands are to be improved, they must be treated and managed as productive crops.

3. Grass species are very responsive to nitrogen fertilization.
4. Legume species accumulate relatively high levels of nitrogen in their tissues even on low N supplying soils due to having a "built-in" supply of nitrogen from rhizobial activity in root nodules. As legume plant parts recycle back through the soil, some of this organic nitrogen mineralizes and can be utilized by grass plants growing in the vicinity. On this basis, interseeding (renovation) of grasslands with adapted legume species represents a means of furnishing nitrogen to the grasses. To maximize nitrogen fixation by rhizobia, molybdenum in soil is largely pH dependent, lime is often needed to adjust soil pH to a level (6-7) which would favor increased molybdenum availability. For this reason, grasslands on acid soils to be improved by renovation with legumes need pH adjusted to somewhat higher levels than for pure grass swards.
5. A working knowledge of how lime and fertilizer react when applied to soil or onto sods. Lime, phosphate, and potash react strongly enough with soil to withstand leaching losses and as a result, can be applied on a longer term basis than fertilizer nitrogen, which reacts very little with soil.
6. If grasses and legumes are grown together in the sward, management must be biased in favor of the legumes in order to maintain it. This involves clipping or grazing management of the grass when establishing the legume to prevent shade-out of the legume until it is firmly established.
7. Where grasslands are grazed, there is considerable recycling of minerals back to the soil. Over a period of years this can result in a surface build-up, particularly of phosphorus and potassium, to the point that little, if any, agronomic response could be expected from further use of fertilizer phosphorus and potassium.
8. If grasslands are clipped for hay or silage, there will be a greater strain put on the soil capacity to provide the plants adequate supplies of minerals, since there will be little recycling of organic materials.

Since grassland farming is a complex system involving soils, plants, and animals, the importance of the producer's ability to accumulate information, make production decisions, and carry them out, cannot be underestimated. In fact, managerial ability and the soils resource are the logical points

from which to start planning for a program of grassland improvement.

DEVELOPING THE FERTILITY PROGRAM

The first step for improving grasslands fertility is to find out soil content of available nutrients, and to determine the level of soil acidity. Soil testing is the best approach to take in obtaining such information. Results of a good representative soil sample from a reliable testing laboratory, and properly interpreted with respect to research findings for the area are the best basis for determining if, and if so, how much lime and fertilizer should be used for providing adequate fertility for the specific species or mixture involved. This initial step with respect to fertility assumes, of course, that decisions have previously been made as to how much, what quality, and when the feed is needed. In other words, the cropping system is already known.

If lime phosphorus, or potassium is needed, it can be broadcast when convenient, preferably after a graze-down, clipping, or during dormancy. Since these elements react with soil to withstand any potential leaching losses, their application can be made with long intervals. The exception to this would be soils with a low capacity for reaction - e.g., sandy textured soils; in this case, potassium may need to be used in applications of shorter interval. Soil levels of these elements can be increased to some desirable range through fertilizer application and can be maintained there without frequent applications. However, soil samples should routinely be taken 3-4 years in order to monitor any changes that take place.

Nitrogen, on the other hand, is a mobile nutrient in the soil and has a high potential for losses. When used, it should be applied in split applications during the growing season. This will be discussed later in more detail.

With respect to need for lime on acid soils, keep in mind that (1) if a pure grass sward is used and nitrogen use is heavy, the soil will reacidify more quickly and lime applications may be needed more frequently, particularly on coarse-textured soils, and (2) if legumes are used in the sward, pH levels need to be higher than that for pure grass in order to keep soil levels of molybdenum soluble enough to keep rhizobial activity in root nodules at levels sufficient to supply the nitrogen requirement for good legume growth.

In developing a fertility system, one of the important decisions to make is how to provide nitrogen to the sward.

Generally speaking, nitrogen is the most limiting essential nutrient in soil for grass growth. And there are two basic approaches which can be taken to provide the nitrogen. Each has advantages and disadvantages which relate to production of feed for specific purposes.

One way to supply nitrogen is by use of commercial nitrogen fertilizers. The other way would be to renovate grass fields with legume species which would result in the sward largely obtaining its nitrogen requirements from the atmosphere via rhizobial fixation of nitrogen.

GRASS-NITROGEN SYSTEM

Cool season grasses such as tall fescue, bluegrass, timothy, orchardgrass, and brome grass grow best from early spring into early summer and again in the fall. If moisture and soil test levels of P and K are adequate (medium to high-medium levels) the use of nitrogen greatly stimulates their growth during these periods of peak production.

- 1. Using N to increase total production—Research data over a period of years indicate that dry matter can be increased from about a ton per acre per year with no nitrogen up to about 4 tons/year with up to 200 lb N/acre.
- 2. Using N to shift seasonality of production—Timely applications of nitrogen will increase production of grasses during particular seasons. A topdressing in late winter or in early spring just before growth begins will increase growth so that grazing can begin about 2 weeks ahead of pastures receiving no nitrogen. Another topdressing in late spring following a graze-down or hay clipping will stimulate an increased amount of growth which will carry over into the normally low production period of the summer. Another topdressing following a graze-down or clipping in late summer will stimulate fall growth, which, if properly utilized, will extend grazing several weeks later into the fall and winter.

Advantages of the grass-nitrogen system are that (a) nitrogen can greatly increase dry matter production, and

thereby increase feed or pasture production per unit of land used, (b) nitrogen can increase the protein content of grass forage to levels sufficient for many types of livestock enterprises, and (c) nitrogen can be substituted to some extent for barnlot feeding since it can hasten early grazing and extend late fall and winter grazing. Each of these advantages can be of economic value to the producer, dependent on his own unique farm system and lifestyle.

On the other hand there are few drawbacks relating to nitrogen use on grass. If used excessively or if applied at high levels and the grass undergoes drought stress, high levels of nonprotein nitrogen (primarily nitrate) can accumulate, which if fed could result in poor livestock performance or even poisoning. There is also some evidence that when nitrogen is applied at high levels, a high plant ratios exceed 16:1, digestibility of the forage may be lowered. Lime and fertilizer recommendations for grasslands are summarized in Table 1.

GRASS-LEGUME SYSTEM

Inclusion of an adapted legume into a grass sod eliminates need for use of commercial nitrogen, and thus at current nitrogen prices, can help in lowering production costs. A high-quality feed is also produced, and since legumes are somewhat better adapted for growth during hot weather than the cool-season grasses, the grass-legume sward will usually give good production during the summer months.

This characteristic fits in well with Kentucky's climatic characteristics, and also with the need for high-quality feed by "growing type" animal enterprises such as feeder calves or backgrounding common on many farms during the summer months.

Fields renovated with adapted legumes also have a lot of versatility. Producers quite often find they cannot utilize all such production by grazing and end up making hay. Such hay is usually high-quality, and if properly cut and stored, results in a stored feed which is satisfactory in quality for growing or lactating animals.

The grass-legume system requires more agronomic-type management than the grass-nitrogen, because as mentioned previously, management must be biased to favor growth and maintenance of the legume. This means watching soil acidity closely, and generally maintaining soil levels of phosphorus and potassium at somewhat higher levels than for grasses alone. Lime and fertilizer recommendations for renovation are shown in Table 2.

For specific recommendations to renovate grasslands with legumes, read publication AGR-26, "Renovating Grass Fields," available in County Extension offices.

FERTILITY AND FEED QUALITY

Plants grown on soils with good fertility levels not only are more likely to produce higher yields, but are also likely to contain higher concentrations of minerals. And ultimate animal performance can be directly affected by this quality effect which relates back to the soil. For this reason a program of feed analysis is a management tool in this whole "soil-plant-animal system" approach to production which should be used for developing least-cost rations. This is particularly important for stored feeds. The "feed value" of grassland forages is affected by soil fertility and, thus large contributor to livestock performance.

SUMMARY

Grassland farming is a complex system in which economic success is dependent on a wide spectrum of factors, only one of which is soil fertility. Nevertheless, the fertility system is the keystone to success, because animal performance is largely dependent on adequate amounts of feed of adequate quality when needed, and this is largely dependent on the soil-available supplies of nutrients to enable such growth.

Programs for grasslands improvement should begin with an inventory of soil available nutrients and should include an inventory of feed value of the forage produced. If lime, phosphorus or potassium is needed, these fertilizers can be applied at much longer intervals than nitrogen because they react strongly enough with most soils to reduce the likelihood of leaching losses. When nitrogen is used, it should be applied in split applications since it does not react strongly with soil and soil levels are not likely to be built high enough to last for more than 1-2 months of good production. Legumes can be used in grasslands improvement, not only as a means of supplying nitrogen to the sward, but also to increase feed quality and to provide versatility. Use of some fields for the grass nitrogen system and other fields for the grass-legume system offers the opportunity to many producers for developing a least-cost forage production system to provide required quantities of desired quality feed when needed.

Table 1. Lime and fertilizer recommendations for grasslands.

LIME

Lime to raise soil pH to 6.0-6.5

NITROGEN-PHOSPHATE-POTASH

Lb/A Per Year to Topdress ¹			
Soil Test Level	N ²	P ₂ O ₅	K ₂ O
High (over 60 P, 250 K)	up to 200	0	0
Medium (60-30)P, 250-165 K)	up to 200	0-80	0-40
Low (less than 30 P, 165 K)	up to 200	80-120	40-80

¹Increase P₂O₅ by 20 lb/A and K₂O by 40 lb/A if fields are for hay.

²Total amount of N to topdress should be dependent on how additional production is needed. IF a total of more than 100 lb. of N per acre is to be used, it should be applied in split applications. Suggested dates and rates for topdressing with N are shown below.

WHEN TO TOPDRESS NITROGEN —

Date	Lb N/A Per Application
Feb. 15-March 15	up to 100
May 1-15	up to 50
Aug. 1-15	up to 80

Table 2. Lime and fertilization recommendations for renovating grasslands with legumes.

LIME

Lime to raise soil pH to near 6.5

NITROGEN

One of the critical factors in establishing legumes in established grass sods is grass competition with young legume seedlings. Use of N at renovation time will stimulate grass growth and increase the likelihood of failure in getting a stand of the legume.

PHOSPHATE AND POTASH

Lb/A to Apply When Renovating		
Soil Test Level	P ₂ O ₅	K ₂ O
High (over 60 P, 250 K)	0	0
Medium 60-30 P, 250-165 K)	0-80	0-80
Low (less than 30 P, 165 K)	80-120	80-120

Coal Calendar

SEPTEMBER

- 6-7 Second Annual Coal Exhibit and Seminar, El Hasa Shrine Temple, Ashland, KY., contact Susan Ennis, Coal Operators Appreciation League, 207 15th St., P.O. Box 830, Ashland, Ky., 41105, (606) 324-5111.
- 8-11 Annual Convention, West Virginia Petroleum Marketers Association, Greenbrier Hotel, White Sulphur Springs, contact WVPMA, Suite 806, Atlas Bldg., Charleston, 25301, (304) 343-5885.
- 10-11 West Virginia Chamber of Commerce Congressional Executive team Visitation, Washington, D.C., contact WV Chamber, P.O. Box 2789, Charleston, 25301, (304) 342-1115.
- 11-13 Greater Bluefield Coal Show, Brush Fork Armory, Bluefield, contact T.A. Dalesio, Bluefield Chamber of Commerce, Bluefield, 24701, (304) 327-7184.
- 15-20 Seventeenth Annual Interagency Evaluation Tour of Surface Mining and Reclamation in West Virginia, headquartered in Bluefield/Princeton and Morgantown, contact Howard Skidmore or Priscilla Ailes, West Virginia Department of Energy, 1615 Washington St. E., Charleston, 25311, (304) 348-3500.
- 16-17 Ninth Annual "Coal Marketing Days," Hyatt Pittsburgh, Chatham Center, Pittsburgh, Pa., contact Coal Outlook, 1401 Wilson Blvd., Suite 910, Arlington, Va., 22209, (703) 528-1244.
- 16-20 WVU Short Course, "Professional Engineer Examination Review," Morgantown, contact Department of Mining Engineering, West Virginia University, P.O. Box 6070, Morgantown, W.V., 26506, (304) 293-5695.
- 16-20 Second Annual Pittsburgh Coal Conference, Pittsburgh Hilton Hotel, Pittsburgh, Pa., contact Pittsburgh Coal Conference, MEIMS, One Northgate Square, Garden Center Dr., P.O. Box 270, Greensburg, Pa., (412) 836-6813.
- 22-25 American Mining Congress, 1985 Mining Convention, San Francisco, Cal., contact AMC, Suite 300, 1920 N St. NW, Washington, D.C., 20036, (202) 861-2834.
- 23-27 Annual Meeting, Interstate Mining Compact Commission, Asheville, N.C., contact Kenes Bowling, Executive Director, IMCC, 1364 Davenport Dr., Lexington, Ky., 40504, (606) 253-1576.
- 25-26 West Virginia Conference on the Environment, Charleston House Holiday Inn, Charleston, contact WV Chamber of Commerce, P.O. Box 2789, Charleston, 25330, (304) 342-1115.
- 26 Seminar, "Occupational Hearing Loss," Marriott Hotel, Charleston, contact McDonough Caperton Employee Benefits, One Hillcrest Drive E., P.O. Box 3741, Charleston, 25337, (304) 346-0611.
- 26-27 "The Fundamentals and Technical Aspects of Coal Mining, 1985 Symposium and the Maryland Coal Association, Sheraton Lakeview Resort and Conference Center, Morgantown, contact MCA, 59 E. Main St., Frostburg, Md., 21532, (301) 689-6609.

OCTOBER

- 1-3 Annual Meeting, National Association of State Land Reclamationists, Orlando, Fla., contact Leslie Cole, NASLR, P.O. Box 11910, Iron Works Pike, Lexington, Ky., 40578, (606) 252-2291.
- 3-6 Coal Lawyers Conference, Saddlebrook Resort, Wesley Chapel, Fla., contact the National Coal Association, 1130 17th St. NW, Washington, D.C., 20036, (202) 263-2625.

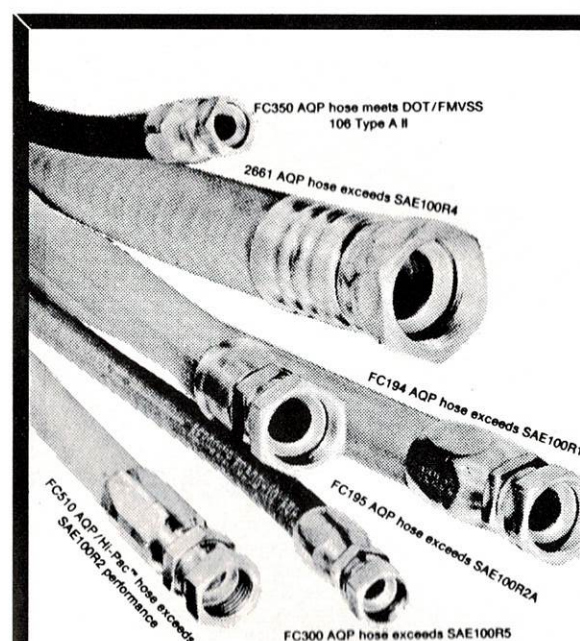
Coal Calendar *continued...*

OCTOBER

- 8-10 Annual Meeting, American Society for Surface Mining and Reclamation, Denver, Colo., contact Bill Plass, Executive Secretary, ASSMR, 21 Grandview Dr., Princeton, 24740, (304) 425-8332.
- 12-15 85th Annual Meeting, American Society of Landscape Architects and Educational Exhibit, Cincinnati Convention Center, Cincinnati, O., contact ASLA 1733 Connecticut Ave. NW, Washington, D.C. 20009.
- 18-27 1985 International Capital Goods Trade Fair, International Exposition Center, Cleveland, O., contact 1985 International Capital Goods Trade Fair, 6200 Riverside Dr., Cleveland, O., 44135.
- 22-25 1985 World Energy Congress, Georgia World Congress Center, Atlanta, Ga., contact World Energy Engineering Congress, 4025 Pleasantdale Rd., Suite 340, Atlanta, Ga., 30340.
- 23-24 Wetlands and Water Management on Mined Lands, University Park, Pa., contact Agricultural Conference Coordinator -- Wetlands, 409 J.O. Keller Conference Center, University Park, Pa. 16802, (814) 865-9547.

NOVEMBER

- 15-16 Fall Board of Directors Meeting, West Virginia Mining & Reclamation Association, Sheraton Lakeview Resort and Conference Center, Morgantown, contact Patty Bruce, WVMRA, 1624 Kanawha Blvd. E., Charleston, 25311, (304) 346-5318.



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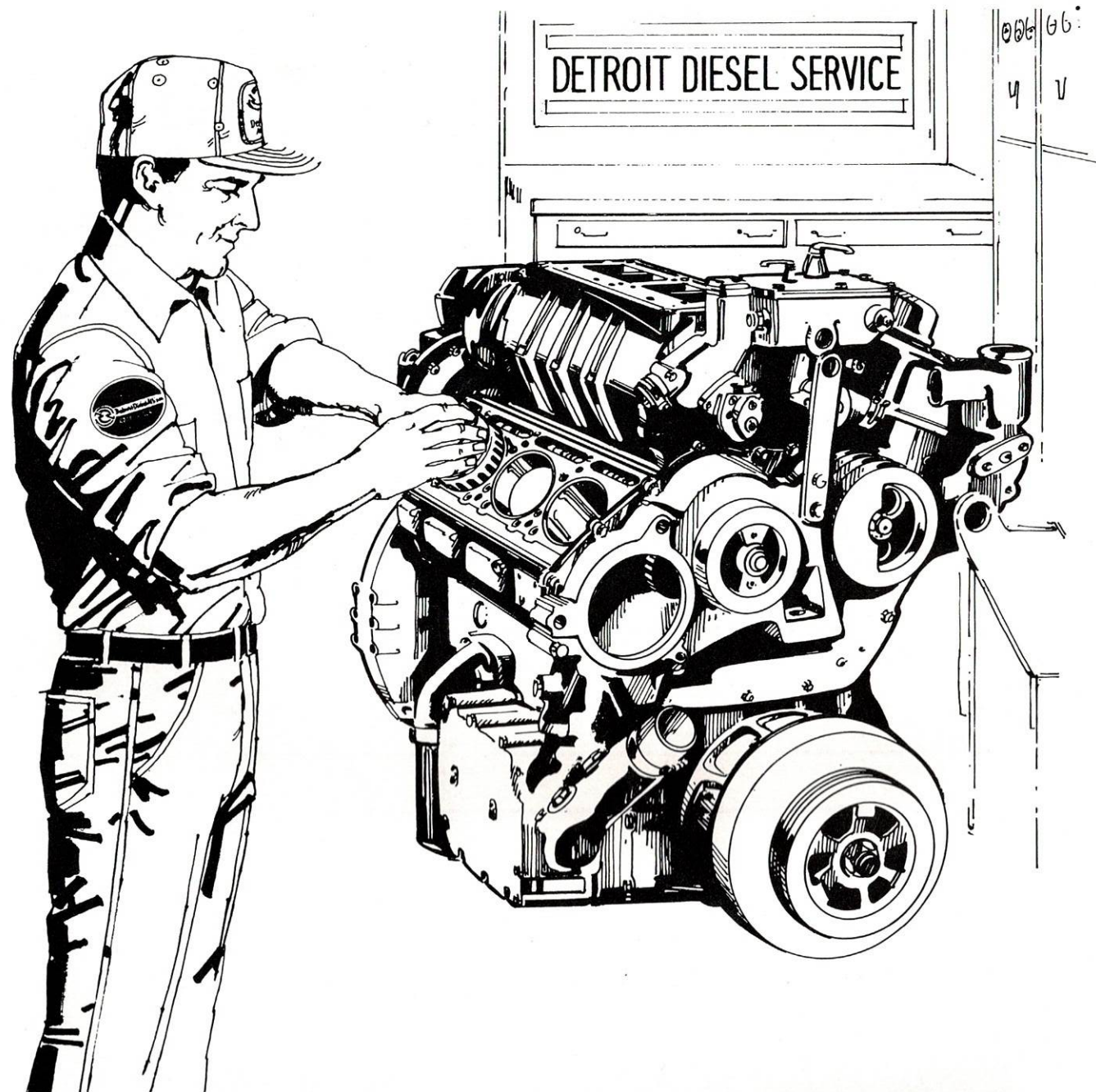
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